HUGHES

HUGHES AIRCRAFT COMPANY

INSTRUCTION MANUAL

MODEL 1400H SERIES

TRANSISTOR POWER AMPLIFIER

MP MASTER

MA34957

ELECTRON DYNAMICS DIVISION

3100 West Lomita Boulevard, Torrance, California 90509, Tel (213) 534-2121

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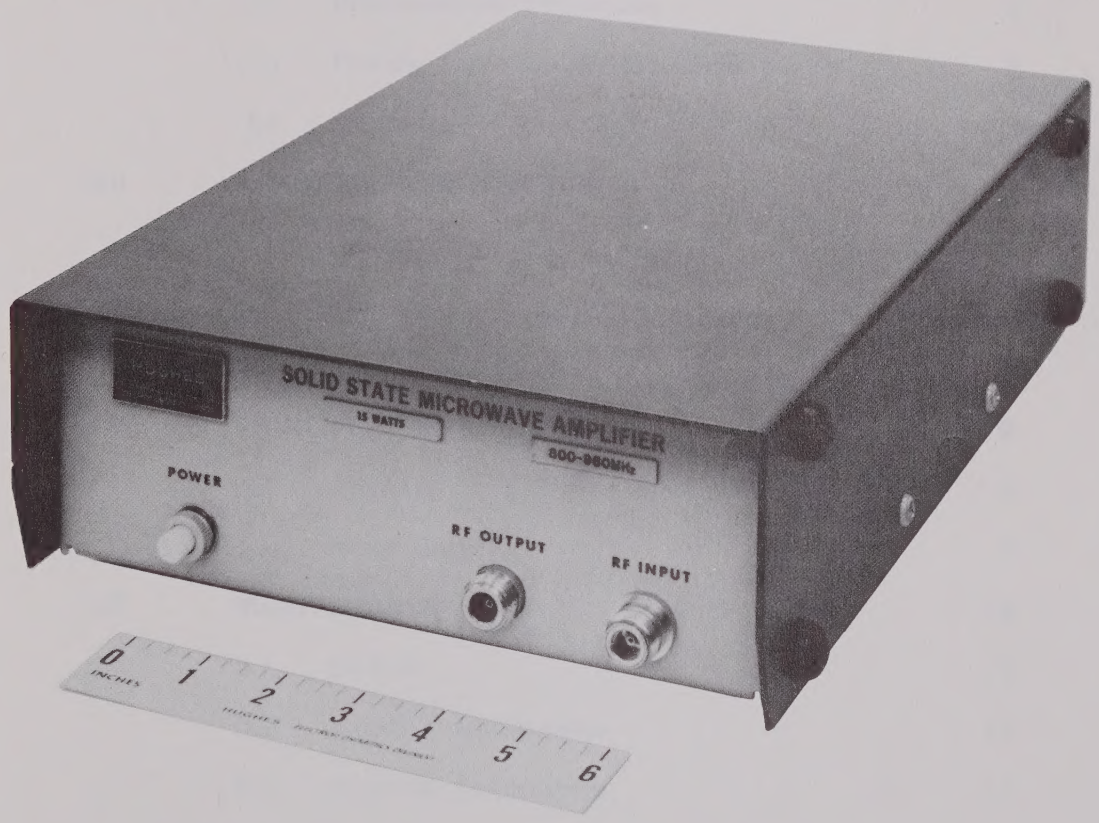

3100 WEST LOMITA BOULEVARD, TORRANCE, CALIFORNIA 90509

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1.0 GENERAL INFORMATION

1.1 DESCRIPTION

The Hughes Model 1400H Series Transistor Power Amplifiers are designed for instrumentation application. The amplifiers are ruggedly constructed yet maintain simplicity in design for ease of operation and maintenance. The 1400H amplifiers provide RF amplification within certain specified frequency limits or bandwidths between 50 MHz and 2.4 GHz. Output power ranges are from 1 to 20 watts with an RF gain of from 10 to 40 dB.

1.2 SPECIFICATIONS

1.2.1 Mechanical Specifications

The mechanical specifications of the 1400H amplifiers are detailed in the installation and control drawing in Appendix II.

1.2.2 Electrical Specifications

Refer to the appropriate data sheet in Appendix I.

2.0 INSTALLATION

2.1 RECEIVING INSPECTION

Unpack and save packing materials until the following mechanical and electrical inspections have been made:

a) Mechanical Inspection – Check for physical damage. If damage is noted, file a claim with the carrier.

b) Electrical Inspection – Compare the amplifier's performance with the specifications on the appropriate data sheet in Appendix I.

2.2 ENVIRONMENTAL LIMITATIONS

The 1400H amplifier is designed to operate in a temperature environment from 0^{o}C to $+50^{o}$C. Models having primary AC power ratings of 140 watts or greater are specified for ambient temperatures of $+15^{o}$C to $+35^{o}$C.

2.3 PRIMARY INPUT POWER REQUIREMENTS

The amplifier requires a 108 – 132 VAC, 50 – 60 Hz, AC power source. Amplifiers with option 001 are set up for operation from 198 – 255 VAC, 50 – 60 Hz. Operation from regulated or unregulated DC power sources is possible via the "Auxiliary Input" socket at the rear of the unit.

CAUTION:
Auxiliary DC operation is not feasible for extended operation of high power models having primary AC power ratings of 140 watts or greater. This is because the required forced air (fan) cooling system used in these instruments is non-operative in this mode. Refer to specifications for the AC input power ratings.

2.4 MOUNTING

A. The standard 1400H amplifier is designed for bench use. It may be mounted in any of two positions:

1. Upright with handle at left, or

2. On its side with handle at top.

   Optional rack mounting adapters are available.

B. 1400H amplifiers with an AC input power rating of 140 watts or greater must be mounted to allow for adequate ventililation. A minimum 1 inch clearance must be provided on the top, bottom and sides of the amplifier. An internal fan circulates air from the intake at the rear of the unit and exhausts through ventilation holes on the bottom near the front panel. Care must be taken to prevent any interference with this air flow.

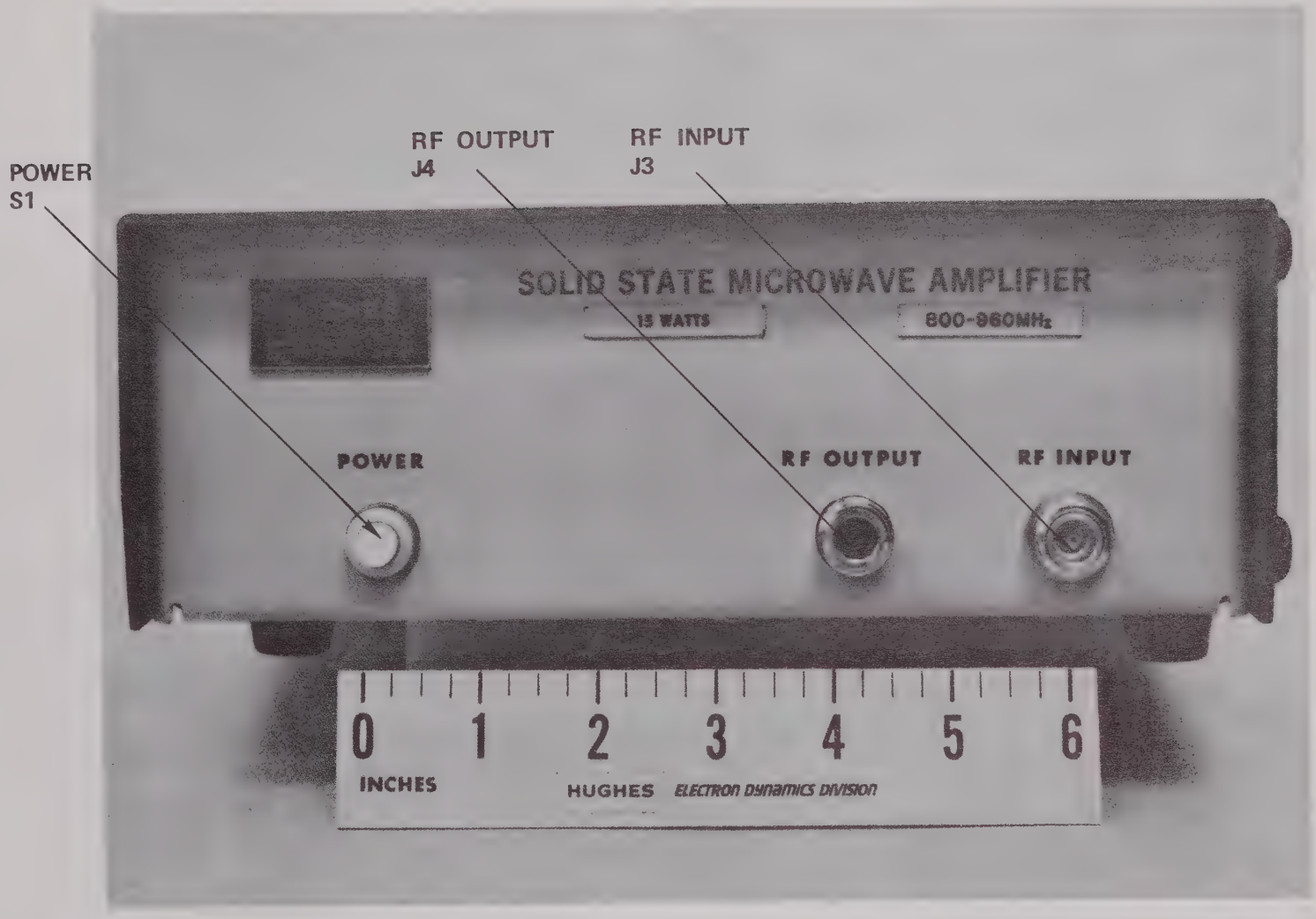


Figure 3.0 Front panel.

3.0 OPERATING INSTRUCTIONS

3.1 CONNECTIONS

A. "AC INPUT" – Primary AC power input (rear panel).

1. The amplifier is supplied with a mating connector and a three–conductor AC power cord.

2. The "center" (green) conductor is internally grounded to the amplifier chassis.

3. The "hot" (white) conductor is fused at the amplifier.

B. "AUX INPUT" – Auxiliary test input (rear panel).

1. The amplifier is supplied with a keyed plug installed in the "AUX INPUT" socket.

2. This plug must be installed for normal operation.

3. This socket provides for the following:
   a) Operation of DC regulator and RF amplifier sub–assembly from an external DC power source (refer to the power supply schematics in the Appendices for connections).
   b) Independent monitoring of the power supply and DC regulator.

C. "RF INPUT" – RF input power is applied via a type N jack connector (front panel).

D. "RF OUTPUT" – RF output power is taken via a type N jack connector (front panel).

3.2 CONTROLS AND INDICATORS

"POWER" – power ON–OFF switch. This is the only operating control for the amplifier.

1. This switch controls the primary AC input power to the amplifier.

2. The switch illuminates in the "ON" position. This provides a visual indication of the presence of AC input voltage.

3.3 TURN–ON PROCEDURES

A. Insure the following:

1. The primary AC power of input requirements of the amplifier are not exceeded by the primary AC power source.

2. The RF input requirements of the amplifier are not exceeded by the RF input power source.

3. The RF input and AC power sources are off.

4. The output load VSWR does not exceed the requirements of the amplifier.

B. Connect the following to the amplifier:

1. Primary AC power cable

2. RF input 50 ohm coaxial cable

3. RF output 50 ohm coaxial cable or other transmission line terminated with a suitable 50 ohm load.

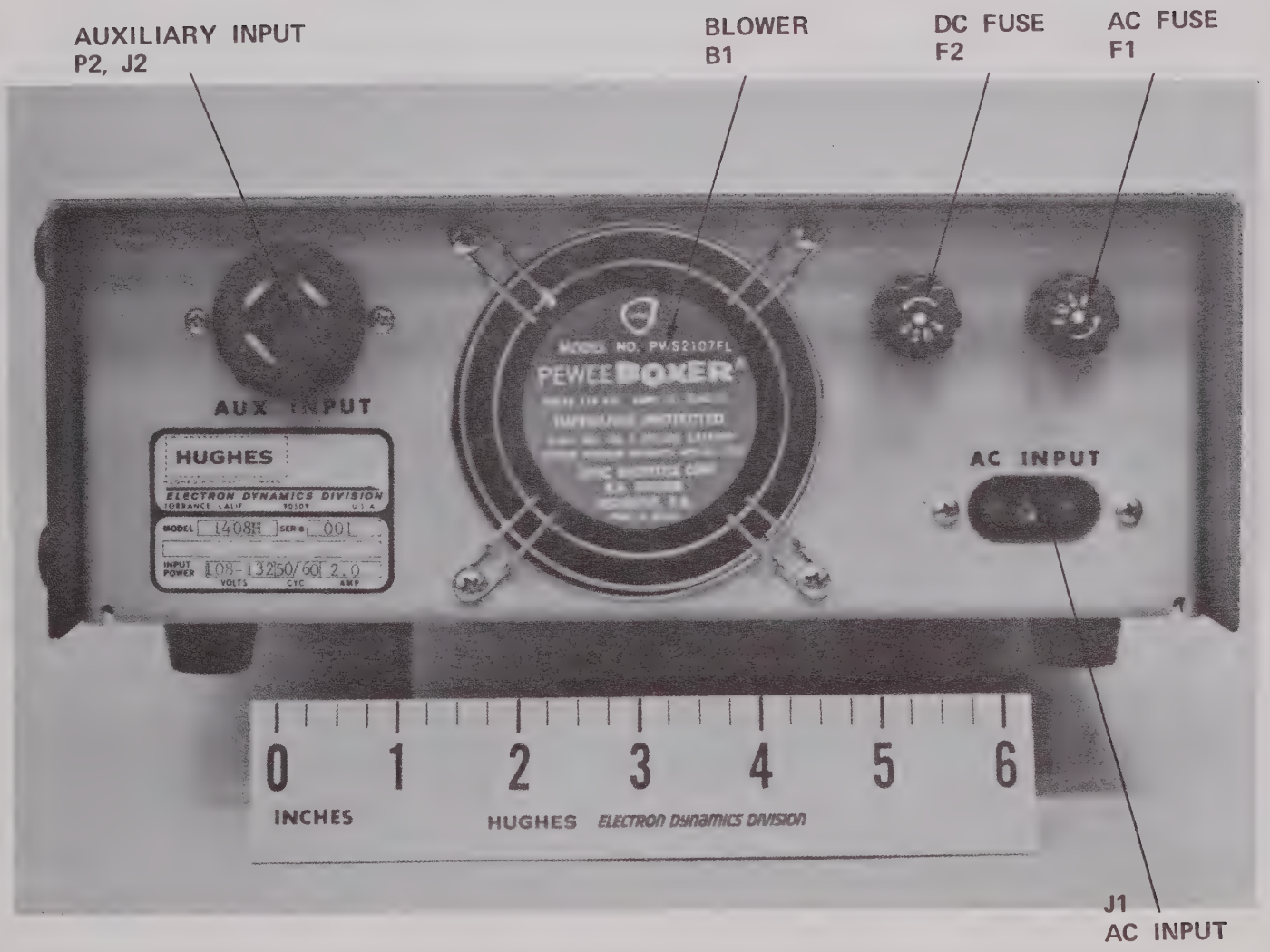


Figure 3.1 Rear Panel

C. Turn–on

1. Push the "POWER" switch in. The internal neon lamp will illuminate.

2. Energize the RF input power source.

3. There is no required sequence for turn–on. Steps 1 and 2 above are interchangeable.

CAUTION:

Certain 1400H amplifiers require loads with a VSWR less than 3:1. These models have a red warning label located on the front panel indicating this load requirement. Exceeding this limit will result in damage to the amplifier.

D. Normal Operating Characteristics

1. The bottom surface of the unit may reach a maximum temperature of 50°C (ambient 25°C environment). This condition will exist during continuous operation at rated output power.

2. High power amplifiers have a thermal cutout feature. In the event that the internal temperature of the amplifier should reach 85°C the unit will shut down. Operation will be restored after cooling to 70°C.

3. After several minutes of operation amplifiers with an internal fan will have warm air flowing from underneath the unit near the front panel.

NOTES:

4.0 PRINCIPLES OF OPERATION

The 1400H transistor power amplifiers consist of the amplifier section and the power supply section. Figure 4.0 shows the basic functional block diagram.

4.1 AMPLIFIER

The 1400H amplifier is a conservatively designed RF amplifier utilizing hybrid microstrip circuitry featuring a unique combination of bias voltage and current regulation to ensure stable operation. Operating points of the transistors are selected for optimum operation and low device operating temperatures, thus increasing the life time of the devices.

The 1400H amplifiers are designed to operate in one of three classes of operation, "A", "AB", or "C". Figure 4.1 shows gain versus power curves of the three classes. Class "A" operation yields the maximum linear per performance and minimum distortion. The Class "AB" amplifier has typically 3 dB greater saturated output power than than Class "A". The higher linear power capacity is its principle advantage. Class "C" operation provides the maximum output power for a given transistor type. The saturated output power is typically 6 dB greater than Class "A" operation when comparing the same transistors. The Class "C" amplifier operates in a non-linear fashion over most of its range. Distortion is greatest in this mode of operation.

4.2 POWER SUPPLY

The 1400H transistor power amplifiers are designed to accept one of several power supplies depending upon the power requirements of the amplifier assembly. The power supplies consist of a large consertively rated power transformer, bridge rectifier, filter capacitors and one or two voltage regulators.

The power transformers used have several voltage taps. This allows for operation at 115 VAC or 230 VAC.

The voltage regulator(s) use precision voltage regulator integrated circuits. This provides superior regulation while keeping the part count down for best reliability and service. There is a precision fine voltage adjustment on each regulator circuit board assembly. This adjustment varies the regulated voltage by one or two volts and is set and sealed by the factory.

The power supplies are protected by fuses in the AC line and DC line. There is further protection against excessive currents, voltage transients and excessive temperatures. Power supply 1400H-002 and -004 have a thermal cutout switch which activates when the internal temperatures of the amplifier reach 85^{o}C. Upon cooling normal operation is restored at 70^{o}C.

The "AUX INPUT" on the rear panel allows for monitoring the unregulated and regulated DC voltages in the amplifier. This feature aids in the maintenance of the unit and if the internal power supply should fail an external DC power supply may be utilized to effect temporary repairs.

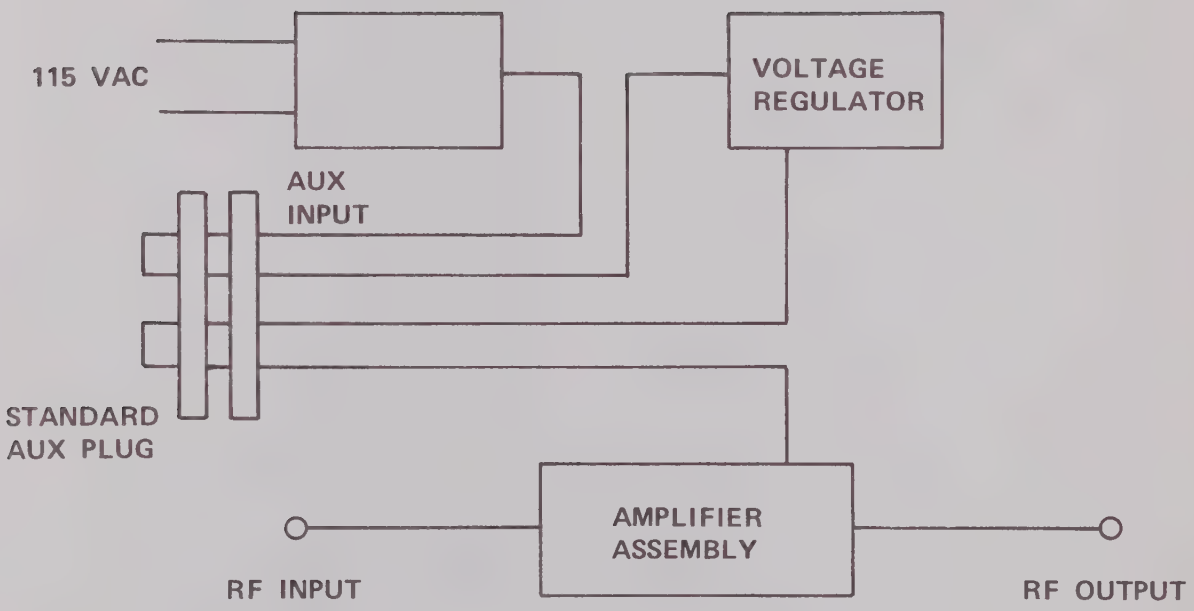


Figure 4.0 Functional block diagram.

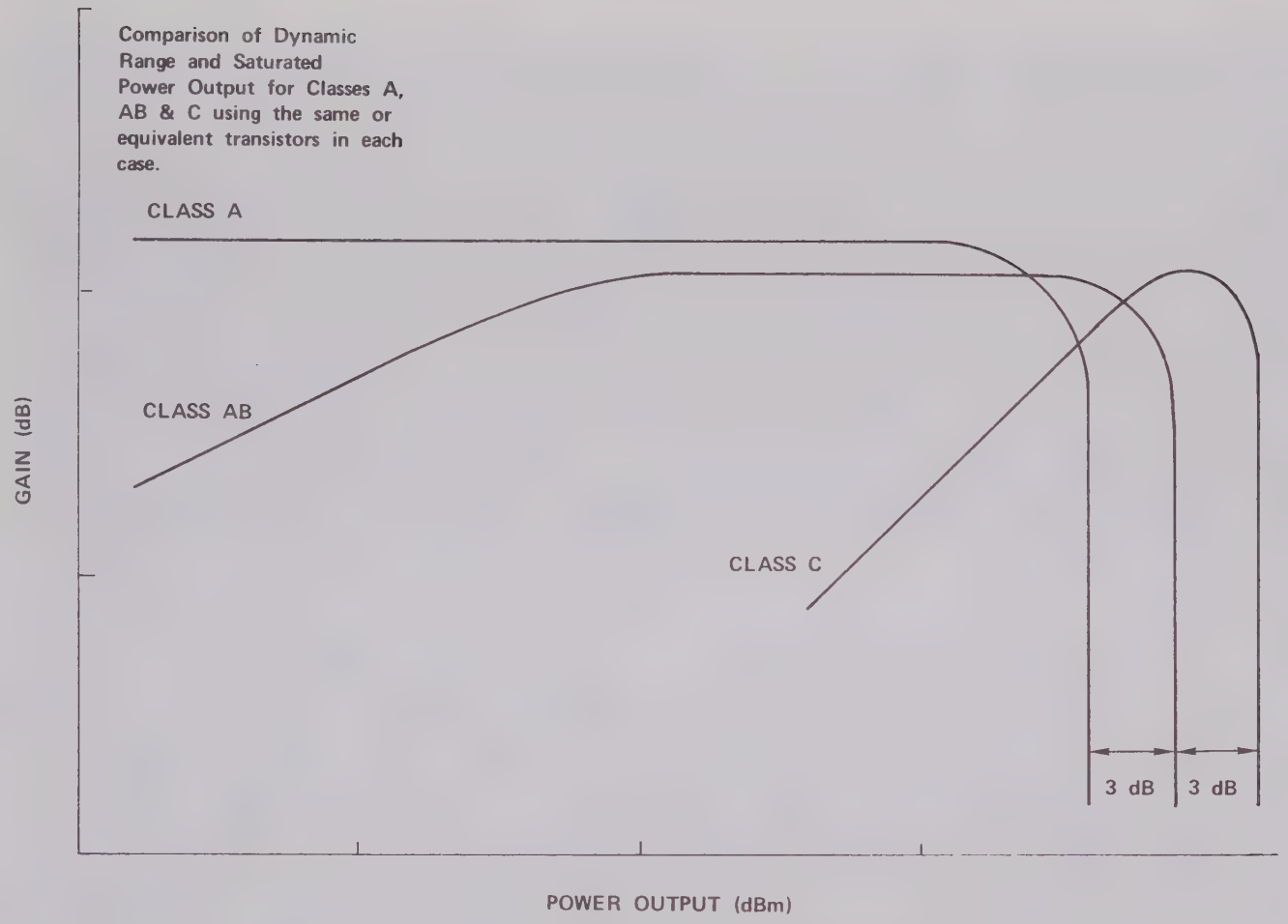

Comparison of Dynamic Range and Saturated Power Output for Classes A, AB & C using the same or equivalent transistors in each case.
CLASS A
CLASS AB
CLASS C
3 dB
3 dB
GAIN (dB)
POWER OUTPUT (dBm)

Figure 4.1 Classes of Operation.

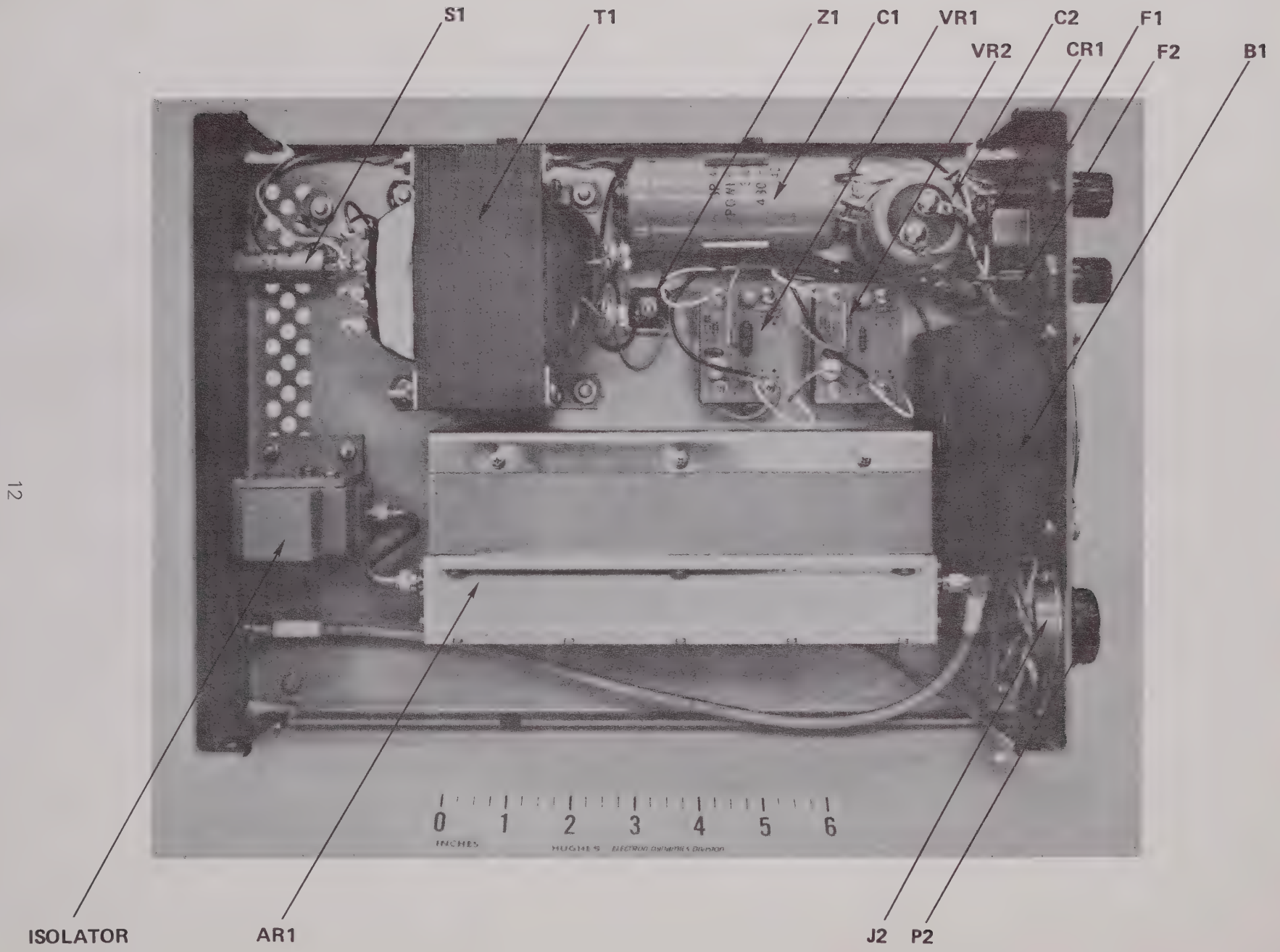


Figure 5.0 Component identification.

5.0 MAINTENANCE

5.1 GENERAL

This section contains instructions for testing, troubleshooting and servicing the 1400H Series Transistor Power Amplifiers. Several precautions should be taken while troubleshooting and servicing the unit.

A. This instrument contains lethal voltages. The 115 VAC is present at several locations in the unit. Extreme caution should be used when operating the unit.

B. Operation of the amplifier without a suitable RF load may damage the amplifier assembly. Be sure an adequate load is provided at all times.

The interior layout of the unit is shown in Figure 5.0. Refer to Appendix III for replacement parts.

5.2 AMPLIFIER MAINTENANCE

The amplifier assembly is not field serviceable. The complete 1400H amplifier should be returned to the factory if servicing is required on this item. Do not return just the amplifier module.

5.3 AMPLIFIER PERFORMANCE

To check the amplifier performance measure power characteristics per connections in Figure 5.1.

A. Set the sweep generator (CW) to center frequency.

B. Increase input power until maximum deflection occurs on output power meter.

C. The power meters should indicate readings per specifications in Appendix I, Data Sheets.

D. Set the sweep generator to the swept mode.

E. Observe the sweep output response on the oscilloscope to be free of discontinuities and oscillations.

5.4 POWER SUPPLY MAINTENANCE

Various power supply configurations are used in the 1400H Series Amplifiers. This is due to different power requirements of the amplifier assemblies. The power supplies are identified by 1400H–001, 002, 003 and 004. Special power supplies for custom amplifiers are identified by 1400H–XXX. The schematics and specifications tables for the different power supply configurations are located in the appendices.

5.5 POWER SUPPLY PERFORMANCE

To test the power supply set up the amplifier as in Figure 5.1 or connect a suitable load. Measure voltages at the "AUX INPUT" as follows.

A. PIN 2. This is the unregulated DC line.

B. PIN 3 and/or PIN 5. This is the regulated voltage(s) from the voltage regulator.

C. Compare the results to the specification table in the appropriate appendix.

5.6 TROUBLESHOOTING PROCEDURE

A. Amplifier Assembly. The amplifier assembly is not field serviceable. The complete 1400H amplifier should be returned to the factory if servicing is required on this item. Do not return just the amplifier module.

B. Power Supply. The power supply can be investigated easily with the use of the "AUX INPUT" on the rear panel.

1. Perform the power supply performance test in Paragraph 5.5.

2. If the voltage at PIN 2 is zero or low, remove the Aux plug and if the voltage is restored, the regulator is defective. If the voltage is still low, then the basic unregulated power supply supply section is defective. See the trouble-shooting guide.

3. If the PIN 3 and/or PIN 5 voltage is unsatisfactory and the PIN 2 voltage is ok, then the regulator is defective.

TABLE 5.0
TROUBLESHOOTING GUIDE

SYMPTOM	POSSIBLE CAUSE
No power	Power supply failure amplifier assembly failure
Power supply failure	Check F1, power switch, power transformer, bridge rectifier, filter capacitor and the regulator.
Regulator failure	Check the voltage at the cathode of VR1 for 33 volts. Check the pass transistor(s). Check the regulator IC.
Amplifier failure	Check the input signal to be properly connected. Check the output to be properly connected.

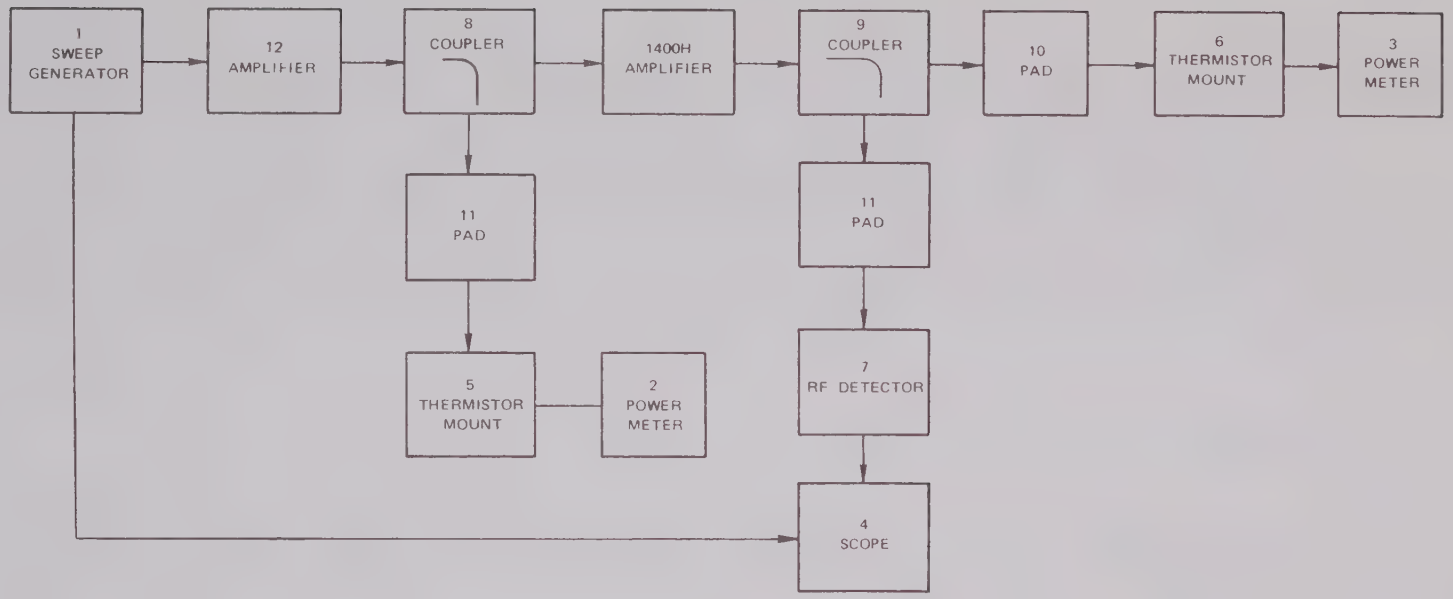


Figure 5.1 Typical RF test set-up.

TABLE 5.1
RECOMMENDED EQUIPMENT FOR RF TEST

ITEM	DESCRIPTION	FREQUENCY (MHz)					
		50–500	500–1000	800–960	750–1500	1000–2000	1700–2400
1	Sweep Gen. (Main frame) Plug In	Systron Donner 540 571–1	→	→	→	→	→
2	Power Meter	HP432A	→	→	→	→	→
3	Power Meter	HP432A	→	→	→	→	→
4	Oscilloscope	TEK561A	→	→	→	→	→
5	Thermistor Mount	HP478A	→	→	→	→	→
6	Thermistor Mount	HP478A	→	→	→	→	→
7	RF Detector	HP423A	→	→	→	→	→
8	Coupler	NARDA 3020A	3041–20	3041–20	HP778D	3022	3022
9	Coupler	NARDA 3020A	3041–20	3041–20	HP778D	3022	3022
10	PAD	NARDA 766–10	766–20	NARDA 766–30	777C–10	777C-20	777C–20
11	PAD	–	–	NARDA 766C–10	–	–	–
12	Amplifier	–	–	1402H	–	–	–

APPENDIX I
DATA SHEETS

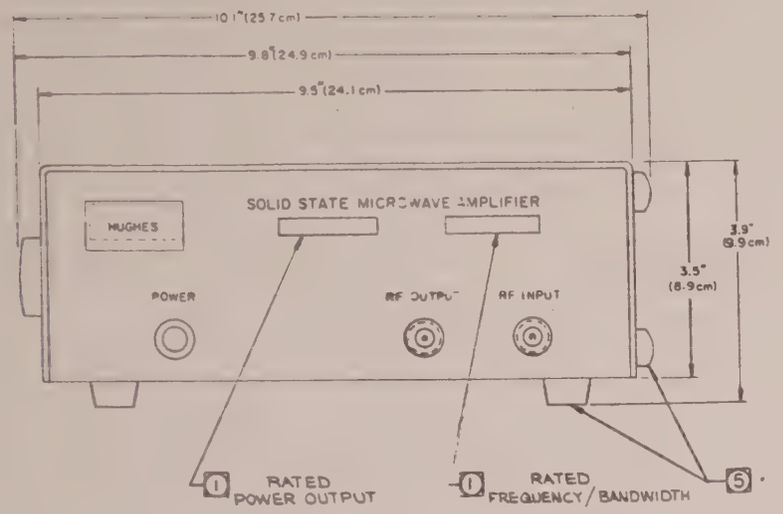
NOTE:

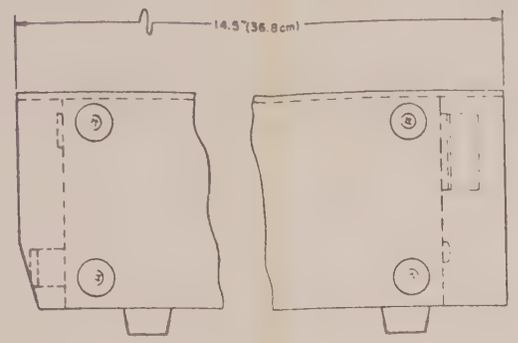
HAC EDD PROJECT ADMINISTRATOR

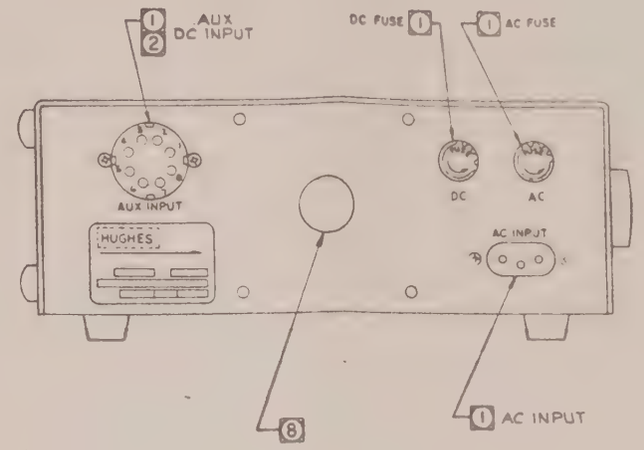
UPON SALE OF AN AMPLIFIER, REMOVE THIS PAGE AND INSERT CORRESPONDING DATA PACKAGE.

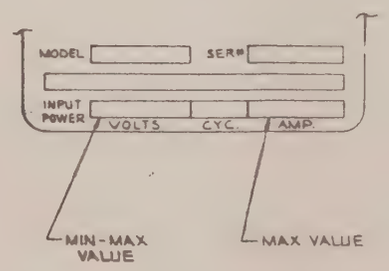
APPENDIX II
INSTALLATION AND CONTROL DRAWING
1400H
TRANSISTOR POWER AMPLIFIERS

PART NO
ICB129000-001









NOTES:

1. FOR THESE AND OTHER SPECIFICATIONS REFER TO THE CATALOG SPECIFICATION SHEET.
2. UNIT IS SUPPLIED WITH KEYED PLUG INSTALLED IN THE "AUX INPUT" RECEPTACLE AT THE REAR OF THE UNIT. THIS PLUG MUST BE INSTALLED FOR AC OPERATION AND REMOVED FOR DC OPERATION. JUMPER WIRES ON PLUG ARE OMITTED FOR CLARITY.
3. WEIGHT: 13-16 LBS NOMINAL.
4. RF CONNECTORS ARE TYPE N, JACK.
5. THIS INSTRUMEMENT MAY BE OPERATED IN TWO DIFFERENT PLANES. OPTIONALLY, A RACK MOUNTING ADAPTER KIT IS AVAILABLE.
6. FINISH: CHASSIS, EPOXY PER FED-STD-595, CHIP 26973, COLOR GRAY, SEMI-GLOSS.
7. FINISH: CHASSIS COVER, PERMA RESIN PER FED-STD-36118, COLOR BLUE-GRAY
8. A FAN IS USED ON SOME MODELS. FOR USAGE REFER TO TABLE.

RELEASED PRINT

QTY REQD	CODE IDENT.	PART NO. OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	ZONE	FIND NO
		PARTS LIST			

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
.XXX ±.005 .XX ±.02
ANGLES ±0° 30' FINISH 63
EDGES & CORNERS .010 R MAX

HUGHES — HUGHES AIRCRAFT COMPANY, ELECTRON DYNAMICS DIVISION, TORRANCE, CALIF. 90509

SOLID STATE MICROWAVE POWER AMPLIFIER, MODEL 14XXH SERIES INSTALLATION CONTROL DWG

SIZE	CODE IDENT NO	DRAWING NO	REV
F	73293	ICB129000	—

NEXT ASSY 14XXH — USED ON — APPLICATION

ICB129000 REV

HUGHES AIRCRAFT CO.
ELECTRON DYNAMICS DIVISION

APPENDIX III
REPLACEABLE PARTS LIST

PARTS LIST
POWER SUPPLY ASSY
MODEL 1400H-001

DESIGNATION	DESCRIPTION	MANUFACTURER'S PART NUMBER	MANUFACTURER
	Voltage Regulator, DC	B108054-001	
X1, X2	Fuse Holder	342014	Littlefuse
P2	Connector, Plug	8PB or 86PM8	Cinch or Amphenol
J2	Socket, 8–PIN	77-MIP-8T	American
J1	Connector, AC	H1061-4	Tower
S1	Switch, AC Power	53-55480-121-A1H	Marco–Oak
C3	Capacitor, 1300MFD, 50V	36D132G050AA2A	Sprague
C2	Capacitor, 8000MFD, 50V	91S50-JA83	STM Corp.
C1	Capacitor, 0.1MFD, 500V	5HK-P10	Sprague
Q1	Transistor	2N3055	RCA
CR1	Diode	1N5400	
R1	Resistor, 68K, ¼W	RCR07G83JS	
Z1	Rectifier, Diode Bridge	680-1	Unitrode
T1	Transformer (115VAC/ 230VAC)	8696A	Coast Coil
	Transformer (115VAC only)	F-41X*	Triad
	Power Cord	17258B	Belden

*Alternate part requiring assembly wiring modifications.

PARTS LIST
POWER SUPPLY ASSY
MODEL 1400H-002

DESIGNATION	DESCRIPTION	MANUFACTURER'S PART NUMBER	MANUFACTURER
	Power Cord	17258B	Belden
X1,X2	Fuse Holder	342014	Littlefuse
	Finger Guard	5508	Pamoter
	Fan	PWS2107FL	IMC Magnetics Corp.
J2	Tube Socket, 8 PIN	77-MIP-8T	American
P1	Connector, Aux Plug	86PM8	American
S1	Switch	416-5-1-A1H	Marco-Oak
J1	Connector, AC	H1061-4	Tower
C2	Capacitor, 1300MFD, 50V	36D132G050AA2	Sprague
C1	Capacitor, 4800 MFD, 50V	36D482G050AB2A	Sprague
CR1	Diode	1N5400	
U1	Rectifier, Bridge	680-1	Unitrode
T1	Transformer, 117 VAC, 4A	B109984-001	
Q1, Q2	Transistor	2N6384	
	Voltage Regulator Board Assy	B125075-001 -001	

PARTS LIST

POWER SUPPLY ASSY

MODEL 1400H-003

DESCRIPTION	DESCRIPTION	MANUFACTURER'S PART NUMBER	MANUFACTURER
	Voltage Regulator Board Assy	B125075-001	
	Power Cord	17258B	Belden
X1, X2	Fuse Holder	342014	Littlefuse
J2	Tube Socket 8 PIN	77-MIP-8T	American
P1	Connector, Plug	8PB or 86PM8	Cinch or American
J1	Connector, AC	H1061-4	Tower
S1	Switch, Press-Lite	416-5-1-A1H	Marco-Oak
C2	Capacitor, 1300MFD, 50V	36D132G050AA2	Sprague
C1	Capacitor, 4800MFD, 50V	36D482G050AB2A	Sprague
CR1	Diode	1N5400	
U1	Rectifier, Diode, Bridge	680-1	Unitrode
T1	Transformer, 117 VAC, 4A	B109984-001	
Q1, Q2	Transistor	2N6384	

PARTS LIST
POWER SUPPLY ASSY
MODEL 1400H-004

DESIGNATION	DESCRIPTION	MANUFACTURER'S PART NUMBER	MANUFACTURER
	Power Cord	17258B	Belden
X1, X2	Fuse Holder	342014	Littlefuse
J2	Tube Socket, 8 PIN	77-MIP-8T	American
P1	Connector, Aux Plug	8PB/86PM8	Cinch/American
J1	Connector, AC	H1061-4	Tower
S1	Switch	416-5-1-A1H	Marco-Oak
C2	Capacitor, 1300MFD, 50V	36D482G050AB2A	Sprague
C1	Capacitor, 4800MFD, 50V	36D482G050AB2A	Sprague
	Voltage Regulator Assy	See PLB125075-001	
CR1	Diode	1N5400	
U1	Rectifier, Bridge	680-1	Unitrode
T1	Transformer	B109984-001	
Q1, Q2	Transistor	2N6384	

PARTS LIST
DC VOLTAGE REGULATOR
B125075-001

DESIGNATION	DESCRIPTION	MANUFACTURER'S PART NUMBER	MANUFACTURER
	P.C. BD. DC Regulator	B125076-001	
U1	Integrated Circuit	U5R7723312	Fairchild
R1	Resistor, 0.5Ω, 3W,±10%	RW690R5	
R2	Resistor, 6.2KΩ, ½W,±5%	RCR20G623JS	
R3	Resistor, 0.5Ω, 3W,±10%	RW690R5	
R4	Resistor, 0.12Ω, 3W,±10%	RW69R12	
R5	Resistor, XXXΩ, ¼W,±5%	RCR07GXXXJS	
R7	Resistor, 10KΩ, ¼W,±5%	RCR07G103J5	
R6	Potentiometer, 1K,±20%	3339W-1-102	
C1	Capacitor, 0.1μF, 200V	M39014/02-1350	
C2	Capacitor, 0.1μF, 200V	M39014/02-1350	
C3	Capacitor, 0.1μF, 200V	M39014/02-1350	
C4	Capacitor, 100pF, 500V	CM04F101-ODL	
VR 1	Diode	1N973B	

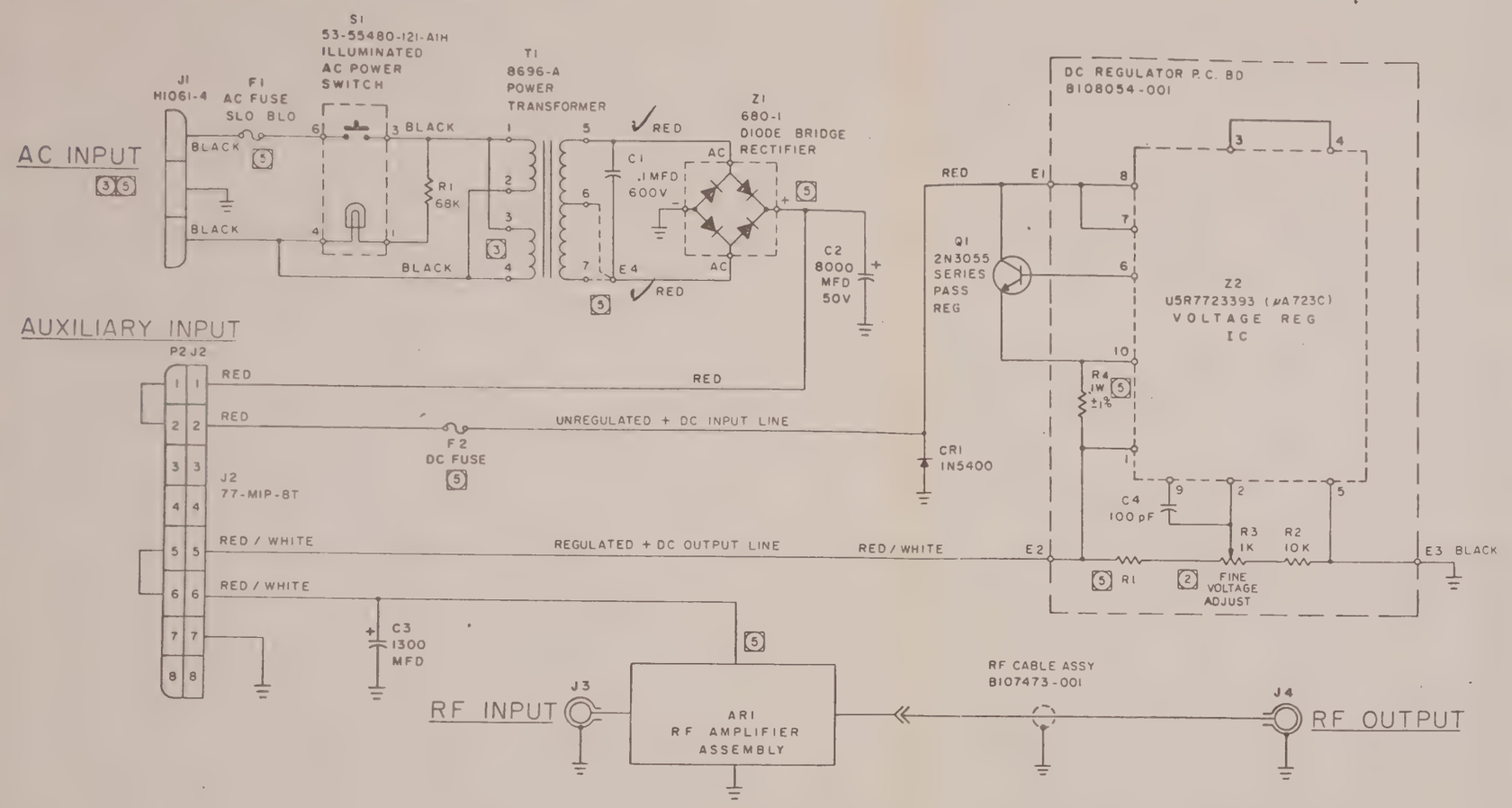
PARTS LIST
DC VOLTAGE REGULATOR
B108054-001

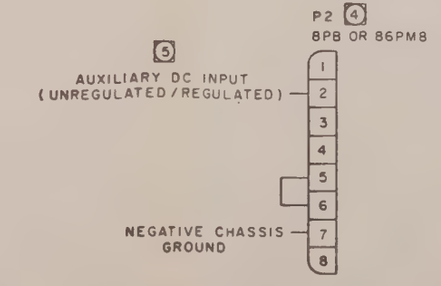
DESIGNATION	DESCRIPTION	MANUFACTURER'S PART NUMBER	MANUFACTURER
	P.C. Board	B107752-001	
Z2	I.C. Regulator	U5R7723393	Fairchild
R4	Resistor, .33Ω, 1W	SA15-.33	Cal–R
R2	Resistor, 10K, ¼W	RCR07G103JS	
R3	Potentiometer, 1KΩ,..75W	77PR1000	Beckman
C4	Capacitor, 100pF	DM10C101D05001CR	Elmenco

APPENDIX IV
SCHEMATIC DIAGRAM 1400H–001
POWER SUPPLY

PART NO.

REVISIONS						
DIV	AUTHORITY	ZONE	LTR	DESCRIPTION	DATE	APPROVED
			A	REDRAWN WITH CHANGES W.S.	10-10-74	





5 FOR NOT LISTED ELECTRICAL SPECIFICATIONS AND POWER TRANSFOMER CONNECTIONS REFER TO B126360 AND OR THE 1400H SERIES DATA SHEET.

4 WIRING OF AUXILIARY INPUT PLUG P2 FOR OPERATION FROM EXTERNAL UNREGULATED / REGULATED DC INPUTS.

3 FOR 198-255 VAC OPERATION T1 PRIMARY WINDINGS 1-2 AND 3-4 ARE CONNECTED IN SERIES.

2 VOLTAGE ADJUSTMENT IS FACTORY SET TO VALUE OF VOLTAGE SPECIFIED ON LABEL OF ARI RF AMPLIFIER ASSY.

1. ALL RESISTOR VALUES ARE IN OHMS, 1/4W ± 5%.

NOTES: UNLESS OTHERWISE SPECIFIED

RELEASED PRINT ENG DOC CONTROL CTR | H REL 10/15/74 | 42 REL DATE | REL BY

QTY REQD	CODE IDENT	PART NO OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	ZONE	FIND NO
			PARTS LIST		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
XXX ± .005 XX ± .02
ANGLES ±0° 30' FINISH 63
EDGES & CORNERS .010 R MAX
MATERIAL

DR B. SOUZA 10-10-74
CHK 22 Oct 74
APPD 10-22-74

HUGHES AIRCRAFT COMPANY
ELECTRON DYNAMICS DIVISION
TORRANCE CALIF 90509

14XXH AMPLIFIER/
1400H-001 POWER SUPPLY,
SCHEMATIC DIAGRAM

NEXT ASSY	USED ON
B121294	1400H-001
APPLICATION	

SIZE F | CODE IDENT NO 73293 | DRAWING NO B121817

SCALE — | SHEET

B121817 A

B121817 A

C

APPENDIX V
SPECIFICATIONS 1400H–001
POWER SUPPLY

REVISIONS						
EFF	AUTHORITY	ZONE	LTR	DESCRIPTION	DATE	APPROVED
			A	1) 1401H EFF WAS 001-032 2) ADDED 1401H, SN 032-050, AND 1401H-001 (46103H-001) AM	7-24-75	8-ca

ASSEMBLY CONTROL TABLE
14XXH SERIES AMPLIFIERS
USING 1400H-001 POWER SUPPLIES

MODEL NO. EFFECTIVITY		SUB-ASSY USAGE		USAGE		POWER REQUIREMENTS						MAINTENANCE SPECIFICATIONS										REFERENCE DETAILS				
INSTRUMENTATION AMPL. SERIES 14XXH		SUB-ASSY IDENTIFICATION				AC INPUT (6)			AUX DC INPUT (OPTIONAL)			FUSE RATINGS (AMPS)		VOLTAGE REGULATOR ASSY(S) (3)								POWER TRANSFORMER				
														DC TEST VALUES (4)						RESISTOR VALUES (5)				PART/ DWG NO	TERMINAL NO. CONNECTIONS			
MODEL NO.	SERIAL NO. EFFECTIVITY	PWR SUPPLY 14-2M DASH NO	RF AMPL MODEL NO.	ISOLATOR	FAN	V		VA	V		A	AC FUSE	DC FUSE	REG NO. 1			REG NO. 2			REG NO. 1		REG NO. 2			PRIMARY		SECONDARY	
														V	A		V	A		R_1	R_4	R_1	R_4		WDG	JUMPER	WDS	JUMPER
						MIN	MAX	MAX	MIN	MAX	MAX	MAX	MAX	NOM	MIN	MAX	NOM	MIN	MAX	NOM	NOM	NOM	NOM					
1401H	001-031	001	46103H	NO	NO	108	132	70	+20	+30	1.0	0.5 SB	1.25	+10	0.5	1.0	NA	NA	NA	3.9K	0.33	NA	NA	8696-A	1,2/3,4	1-3, 2-4	5,6	—
1401H-001		001	46103H	NO	NO	198	255	70	+20	+30	1.0	0.25 SB	1.25	+10	0.5	1.0	NA	NA	NA	3.9K	0.33	NA	NA	8696-A	1,4	2-3	5,6	—
1402	001-026	001	46104H	NO	NO	108	132	100	+28	+38	2.0	0.75 SB	2.0	+24	—	2.0	NA	NA	NA	24K	0.33	NA	NA	8696-A	1,2/3,4	1-3, 2-4	5,7	—
1402H-001		001	46104H	NO	NO	198	255	100	+28	+38	2.0	0.25 SB	2.0	+24	—	2.0	NA	NA	NA	24K	0.33	NA	NA	8696-A	1,4	2-3	5,7	—
1403H	001-022	001	46210H	NO	NO	108	132	70	+22	+32	1.0	0.5 SB	1.25	+18	0.5	1.0	NA	NA	NA	16K	0.33	NA	NA	8696-A	1,2/3,4	1-3, 2-4	5,7	—
1403H-001		001	46210H	NO	NO	198	255	70	+22	+32	1.0	0.25 SB	1.25	+18	0.5	1.0	NA	NA	NA	16K	0.33	NA	NA	8696-A	1,4	2-3	5,7	—
1401H	032-050	001	46103H-001	NO	NO	108	132	70	+20	+30	1.0	0.5 SB	1.25	+18	0.5	1.0	NA	NA	NA	3.9K	0.33	NA	NA	8696-A	1,2/3,4	1-3, 2-4	5,7	—
1401H-001		001	46103H-001	NO	NO	198	255	70	+20	+30	1.0	0.25 SB	1.25	+18	0.5	1.0	NA	NA	NA	3.9K	0.33	NA	NA	8696-A	1,4	2-3	5,7	—

(6) MAXIMUM AC INPUT POWER (VA) VALUES ARE FOR OPERATION OF THE AMPLIFIER UNDER THE FOLLOWING TWO SIMULTANEOUS CONDITIONS:
1) MAXIMUM RATED AC INPUT VOLTAGE.
2) CW OPERATION AT THE RATED POWER OUTPUT LEVEL OR GREATER

(5) RESISTOR VALUE R1 DETERMINES THE COARSE VOLTAGE SETTING OF THE REGULATOR; RESISTOR R4 DETERMINES THE MAXIMUM CURRENT LIMIT SETTING. VALUES ARE SHOWN IN OHMS. VALUES LESS THAN 1 OHM ARE ±1%; ALL OTHERS ARE ±5%

(4) MINIMUM VALUES OF CURRENT (A) ARE FOR QUIESCENT (ZERO SIGNAL/NO RF INPUT) AMPLIFIER OPERATION; MAXIMUM VALUES ARE FOR CW OPERATION AT THE RATED POWER OUTPUT LEVEL OR GREATER.

(3) THE AUXILIARY DC INPUT JACK J2 PROVIDES FOR SIMPLE MAINTENANCE TESTING (REF. NOTE 2) OF THESE DC VOLTAGE(S) AND CURRENT(S).

(2) AUXILIARY DC OPERATION IS NOT FEASIBLE FOR THESE MODELS BECAUSE THE REQUIRED FORCED-AIR (FAN) COOLING SYSTEM IS NON-OPERATIVE IN THIS MODE.

1. NA = NOT APPLICABLE.

NOTES: UNLESS OTHERWISE SPECIFIED

RELEASED PRINT | A | 7-24-75 | 3 SH

QTY REQD	CODE IDENT	PART NO. OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	ZONE	FIND NO
			PARTS LIST		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
.XXX ± .005 .XX ± .02
ANGLES ±0° 30' FINISH 63 EDGES & CORNERS .010 R MAX
MATERIAL

NEXT ASSY	USED ON
	1400H-001
APPLICATION	

DR B. SOUZA 18 OCT 74
CHK [illegible] 29 OCT 74
APPD [illegible] 30 OCT 74

HUGHES — HUGHES AIRCRAFT COMPANY, ELECTRON DYNAMICS DIVISION, TORRANCE, CALIF. 90509

14XXH AMPLIFIER/ 1400H-001 POWER SUPPLY SPECIFICATION TABLE

SIZE	CODE IDENT NO	DRAWING NO
D	73293	B126360

SCALE — SHEET

B126360 A

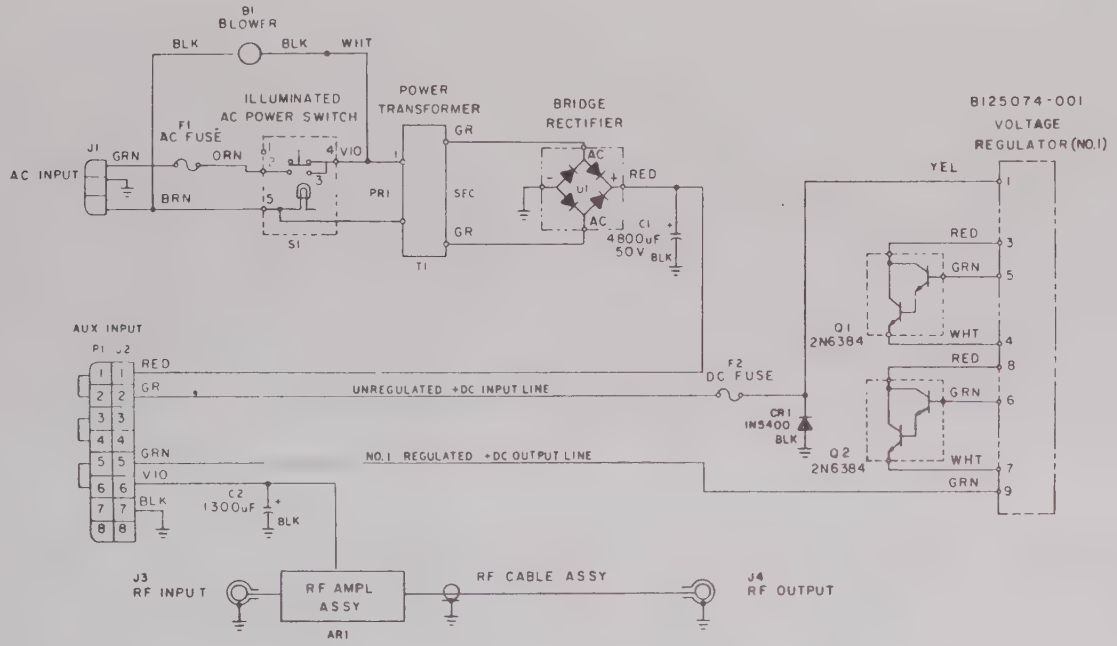
C

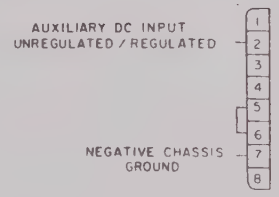
APPENDIX VI

SCHEMATIC DIAGRAM 1400H–002

POWER SUPPLY

REVISIONS					
EFF	AUTHORITY	ZONE	LTR	DESCRIPTION	DATE	APPROVED
			A	REVISED SH 2 AWH	7 21 71	





AUX(EXTERNAL) DC INPUT
PLUG CONNECTION

RELEASED PRINT
ENG DOC CONTROL CTR | A | 7/21/71 | REL DATE | REC BY

QTY REQD	CODE IDENT	PART NO OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	ZONE	FIND NO

PARTS LIST

2 REGULATOR VOLTAGE ADJUSTMENT(S) ARE FACTORY SET TO THE VOLTAGE VALUE (S) SPECIFIED ON THE LABEL OF THE RF AMPLIFIER ASSY. THESE VALUES MAY SUPERSEDE THOSE SPECIFIED IN THE TABLE.

1 FOR ELECTRICAL SPECIFICATIONS AND POWER TRANSFORMER CONNECTIONS NOT LISTED REFER TO TABLE B126356 OR THE CATALOG SHEET

NOTES: UNLESS OTHERWISE SPECIFIED

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
XXX ± .005 XX ± .02
ANGLES ±0° 30' FINISH 63
EDGES & CORNERS .010 R MAX
MATERIAL

NEXT ASSY	1400H-002
APPLICATION	USED ON

DR B. SOUZA 23 SEP 74
CHK
APPD

HUGHES AIRCRAFT COMPANY
ELECTRON DYNAMICS DIVISION
TORRANCE, CALIF. 90509

14XXH AMPLIFIER/ 1400H-002 POWER SUPPY SCHEMATIC DIAGRAM

SIZE	CODE IDENT NO	DRAWING NO
D	73293	B126356

SCALE — SHEET 1 OF 2

FORM MAC 11065-B-CS-ED 7-69 REV 12/70 DIETERICH POST CLEARPRINT 1000H-30

C

APPENDIX VII
SPECIFICATIONS 1400H–002
POWER SUPPLY

REVISIONS					
EFF	AUTHORITY	ZONE	LTR	DESCRIPTION	DATE	APPROVED
			A	ADDED 1406H, 1406H-001, 1411H, AND 1411H-001 AM	12-15-75	

ASSEMBLY CONTROL TABLE
14XXH SERIES AMPLIFIERS
USING 1400H-002 POWER SUPPLIES

MODEL NO EFFECTIVITY		SUB-ASSY USAGE		USAGE		POWER REQUIREMENTS						MAINTENANCE SPECIFICATIONS										REFERENCE DETAILS				
INSTRUMENTATION AMPL. SERIES 14XXH		SUB-ASSY IDENTIFICATION				AC INPUT [6]			AUX DC INPUT [2]			FUSE RATINGS (AMPS)		VOLTAGE REGULATOR ASSY(S) [3]								POWER TRANSFORMER				
														DC TEST VALUES [4]						RESISTOR VALUES [5]						
														REG NO. 1			REG NO 2			REG NO. 1		REG NO 2				
MODEL NO.	SERIAL NO EFFECTIVITY	PWR SUPPLY 14-XXH DASH NO.	RF AMPL MODEL NO.	ISOLATOR	FAN	V		VA	V		A	AC FUSE	DC FUSE	V	A		V	A		R_5	R_4	R_5	R_4	PART/ DWG NO.	TERMINAL NO CONNECTIONS			
																									PRIMARY		SECONDARY	
						MIN	MAX	MAX	MIN	MAX	MAX	MAX	MAX	NOM	MIN	MAX	NOM	MIN	MAX	NOM	NOM	NOM	NOM	NOM		WDG	JUMPER	WDG	JUMPER
1405H	001 & UP	002	46311H	NO	YES	108	132	110	NA	NA	NA	1.0 SB	2.0	+24	0.8	1.5	NA	NA	NA	24K	0.33	NA	NA	B109984	1,6	2-5	8,11	9-10
1405H-001		002	46311H	NO	YES	198	255	110	NA	NA	NA	0.5 SB	2.0	+24	0.8	1.5	NA	NA	NA	24K	0.33	NA	NA	B109883				
1406H	001 AND UP	002	46146H	NO	YES	108	132	150	NA	NA	NA	2.0 SB	3.0	+24	1.5	2.8	NA	NA	NA	24K	0.22	NA	NA	B109984	1,6	2-5	8,11	9-10
1406H-001		002	46146H	NO	YES	198	255	150	NA	NA	NA	1.0 SB	3.0	+24	1.5	2.8	NA	NA	NA	24K	0.22	NA	NA	B109883				
1411H	001 AND UP	002	46148H	NO	YES	108	132	330	NA	NA	NA	3.0 SB	6.0	+20	3.5	6.0	NA	NA	NA	20K	0.10	NA	NA	B109984	1,6	2-5	8,11	9-10
1411H-001		002	46148H	NO	YES	198	255	330	NA	NA	NA	1.5 SB	6.0	+20	3.5	6.0	NA	NA	NA	20K	0.10	NA	NA	B109883				

[6] MAXIMUM AC INPUT POWER (VA) VALUES ARE FOR OPERATION OF THE AMPLIFIER UNDER THE FOLLOWING TWO SIMULTANEOUS CONDITIONS:
1) MAXIMUM RATED AC INPUT VOLTAGE.
2) CW OPERATION AT THE RATED POWER OUTPUT LEVEL OR GREATER

[5] RESISTOR VALUE R5 DETERMINES THE COARSE VOLTAGE SETTING OF THE REGULATOR; RESISTOR R4 DETERMINES THE MAXIMUM CURRENT LIMIT SETTING. VALUES ARE SHOWN IN OHMS. VALUES LESS THAN 1 OHM ARE ±1%; ALL OTHERS ARE ±5%.

[4] MINIMUM VALUES OF CURRENT (A) ARE FOR QUIESCENT (ZERO SIGNAL/NO RF INPUT) AMPLIFIER OPERATION; MAXIMUM VALUES ARE FOR CW OPERATION AT THE RATED POWER OUTPUT LEVEL OR GREATER.

[3] THE AUXILIARY DC INPUT JACK J2 PROVIDES FOR SIMPLE MAINTENANCE TESTING (REF. NOTE 2) OF THESE DC VOLTAGE(S) AND CURRENT (S).

[2] AUXILIARY DC OPERATION IS NOT FEASIBLE FOR THESE MODELS BECAUSE THE REQUIRED FORCED-AIR (FAN) COOLING SYSTEM IS NON-OPERATIVE IN THIS MODE.

1. NA = NOT APPLICABLE.

NOTES: UNLESS OTHERWISE SPECIFIED

QTY REQD	CODE IDENT	PART NO OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	ZONE	FIND NO

PARTS LIST

NEXT ASSY	USED ON
	1400H-002

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
XXX ± .005 XX ± .02
ANGLES ±0° 30' FINISH 63 EDGES & CORNERS .010 R MAX
MATERIAL

DR B. SOUZA DATE 10 OCT 74
CHK
APPD

HUGHES — HUGHES AIRCRAFT COMPANY, ELECTRON DYNAMICS DIVISION, TORRANCE, CALIF. 90509

14XXH AMPLIFIER/ 1400H-002 POWER SUPPLY SCHEMATIC DIAGRAM

SIZE D | CODE IDENT NO. 73293 | DRAWING NO B126356

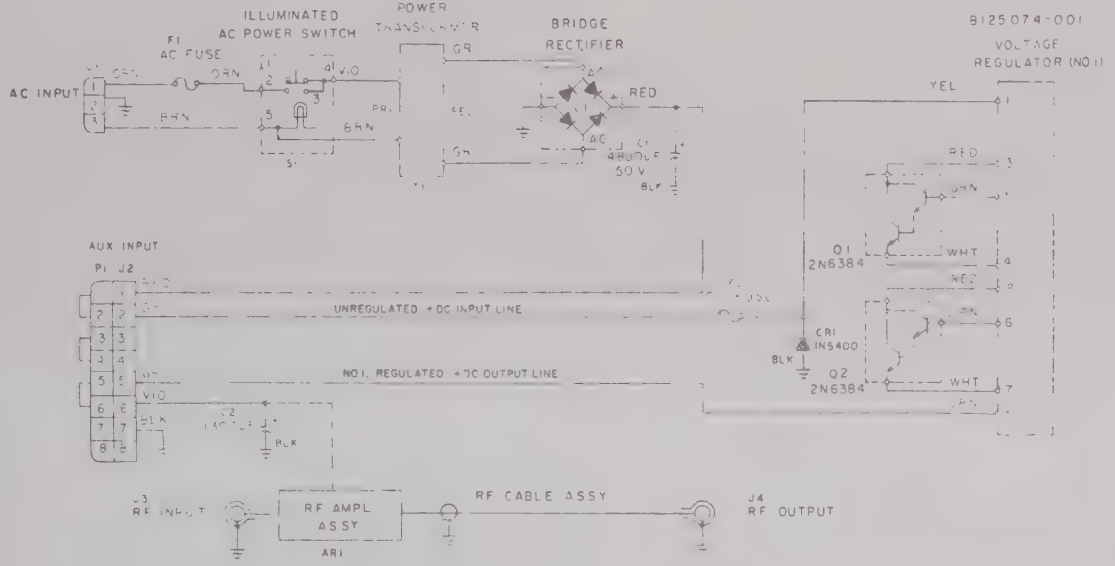
SCALE — | SHEET 2 OF 2

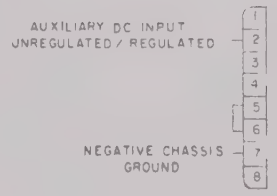
FORM MAC 11093-B (5-ED. 2-68 REV. 12-70) DIETERICH POST CLEARPRINT 1000H-10

B126356 A REV

APPENDIX VIII
SCHEMATIC DIAGRAM 1400H–003
POWER SUPPLY

ECP	AUTHORITY	ZONE	LTR	DESCRIPTION	DATE	APPROVED
			A	REVISED SH 1	AM	





AUXILIARY DC INPUT
PLUG CONNECTIONS

2. REGULATOR VOLTAGE ADJUSTMENT(S) ARE FACTORY SET TO THE VOLTAGE VALUE(S) SPECIFIED ON THE LABEL OF THE RF AMPLIFIER ASSY. THESE VALUES MAY DIFFERENCE THOSE SPECIFIED IN THE TABLE

1. FOR ELECTRICAL SPECIFICATIONS AND POWER TRANSFORMER CONNECTIONS NOT LISTED REFER TO TABLE B126357 OR THE CATALOG SHEET

NOTES: UNLESS OTHERWISE SPECIFIED

RELEASED PRINT

QTY REQD	CODE IDENT	PART NO OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	ZONE	ENG NO

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
FRACTIONS ± ANGLES ±0°30' .X ±.5 .XX ±.XXX
EDGES & CORNERS .010 R MAX
MATERIAL
NEXT ASSY | USED ON
1400H-003
APPLICATION

DRAWN B. SOUZA 10 OCT 79
APPD
APPD

14XXH AMPLIFIER
1400H-003 POWER SUPPLY
SCHEMATIC DIAGRAM

SIZE D | 73293 | B126357
SCALE — SHEET 1 OF 2

B126357 A REV

FORM HAC 11065-B-C5-ED 2/69 REV 12-78 DIETERICH POST CLEARPRINT 1000H 10

APPENDIX IX
SPECIFICATIONS 1400H–003
POWER SUPPLY

REVISIONS					
EFF	AUTHORITY	ZONE	LTR	DESCRIPTION	DATE	APPROVED
			A	1) ADDED 1404H & 1404H-001; & 1401H & 1401H-001 2) DELETED 1401HA & 1401HA-001 AM	7/21/75	

ASSEMBLY CONTROL TABLE
14XXH SERIES AMPLIFIERS
USING 1400H-003 POWER SUPPLIES

MODEL NO EFFECTIVITY		SUB-ASSY USAGE		USAGE		POWER REQUIREMENTS						MAINTENANCE SPECIFICATIONS												REFERENCE DETAILS				
INSTRUMENTATION AMPL SERIES 14XXH		SUB-ASSY IDENTIFICATION				AC INPUT [6]			AUX DC INPUT (OPTIONAL)			FUSE RATINGS (AMPS)		VOLTAGE REGULATOR ASSY(S) [3]										POWER TRANSFORMER				
														DC TEST VALUES [4]						RESISTOR VALUES [5]								
														REG NO. 1			REG NO 2			REG NO 1		REG NO 2				TERMINAL NO CONNECTIONS			
MODEL NO.	SERIAL NO EFFECTIVITY	PWR SUPPLY MODEL NO	RF AMPL MODEL NO	CASE	FAN	V		VA	V		A	AC FUSE	DC FUSE	V	A		V	A		R5	R4	R5	R4	PART/ DWG NO	PRIMARY		SECONDARY	
						MIN	MAX	MAX	MIN	MAX	MAX	MAX	MAX	NOM	MIN	MAX	NOM	MIN	MAX	NOM	NOM	NOM	NOM		WDG	JUMPER	WDG	JUMPER
1401H	051 & UP	003	46111H	NO	NO	108	132	70	+24	+34	1.0	0.75SB	1.5	+24	0.5	1.0	NA	NA	NA	24K	0.33	NA	NA	B 09984	1,6	2-5	8,11	9-10
1401H-001		003	46111H	NO	NO	98	255	70	+24	+34	1.0	0.375SB	1.5	+24	0.5	1.0	NA	NA	NA	24K	0.33	NA	NA	B109883				
1402H	027 & UP	003	46120H	NO	NO	108	132	100	+28	+38	2.0	1.0SB	2.5	+24	—	2.0	NA	NA	NA	24K	0.27	NA	NA	B109984	1,6	2-5	8,11	9-10
1402H-001		003	46120H	NO	NO	98	255	100	+28	+38	2.0	0.5SB	2.5	+24	—	2.0	NA	NA	NA	24K	0.27	NA	NA	B109883				
1403H	023 & UP	003	46211H	NO	NO	108	132		+24	+34	1.0	0.75SB	1.5	+24	0.5	1.0	NA	NA	NA	24K	0.33	NA	NA	B109984	1,6	2-5	8,11	9-10
1403H-001		003	46211H	NO	NO	98	255		+24	+34	1.0	0.375SB	1.5	+24	0.5	1.0	NA	NA	NA	24K	0.33	NA	NA	B109883				
1404H	001 & UP	003	46210H	NO	NO	108	132	70	+24	+34	1.2	0.75SB	1.5	+24	0.5	1.2	NA	NA	NA	24K	0.33	NA	NA	B 09984	1,6	2-5	8,11	9-10
1404H-001		003	46210H	NO	NO	98	255	70	+24	+34	1.2	0.375SB	1.5	+24	0.5	1.2	NA	NA	NA	24K	0.33	NA	NA	B109883				
1407H	001 & UP	003	46221H	NO	NO	108	132	70	+24	+34	1.2	0.75SB	1.5	+24	0.5	1.2	NA	NA	NA	24K	0.33	NA	NA	B109984	1,6	2-5	8,11	9-10
1407H-001		003	46221H	NO	NO	98	255	70	+24	+34	1.2	0.375SB	1.5	+24	0.5	1.2	NA	NA	NA	24K	0.33	NA	NA	B109883				
1415H	001 & UP	003	46130H	NO	NO	108	132	70	+24	+34	1.2	0.75SB	1.5	+24	0.7	1.2	NA	NA	NA	24K	0.33	NA	NA	B109984	1,6	2-5	8,11	9-10
1415H-001		003	46130H	NO	NO	98	255	70	+24	+34	1.2	0.375SB	1.5	+24	0.7	1.2	NA	NA	NA	24K	0.33	NA	NA	B109883				

[6] MAXIMUM AC INPUT POWER (VA) VALUES ARE FOR OPERATION OF THE AMPLIFIER UNDER THE FOLLOWING TWO SIMULTANEOUS CONDITIONS:
1) MAXIMUM RATED AC INPUT VOLTAGE.
2) CW OPERATION AT THE RATED POWER OUTPUT LEVEL OR GREATER

[5] RESISTOR VALUE R5 DETERMINES THE COARSE VOLTAGE SETTING OF THE REGULATOR; RESISTOR R4 DETERMINES THE MAXIMUM CURRENT LIMIT SETTING. VALUES ARE SHOWN IN OHMS VALUES LESS THAN 1 OHM ARE ±1%; ALL OTHERS ARE ±5%

[4] MINIMUM VALUES OF CURRENT (A) ARE FOR QUIESCENT (ZERO SIGNAL/ NO RF INPUT) AMPLIFIER OPERATION; MAXIMUM VALUES ARE FOR CW OPERATION AT THE RATED POWER OUTPUT LEVEL OR GREATER.

[3] THE AUXILIARY DC INPUT JACK J2 PROVIDES FOR SIMPLE MAINTENANCE TESTING (REF. NOTE 2) OF THESE DC VOLTAGE(S) AND CURRENT(S).

[2] AUXILIARY DC OPERATION IS NOT FEASIBLE FOR THESE MODELS BECAUSE THE REQUIRED FORCED-AIR (FAN) COOLING SYSTEM IS NON-OPERATIVE IN THIS MODE.

1. NA = NOT APPLICABLE.

NOTES: UNLESS OTHERWISE SPECIFIED

QTY REQD	CODE IDENT	PART NO OR IDENTIFYING NO	NOMENCLATURE	ZONE	END NO
			PARTS LIST		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
XXX ± .005 XX ± .02
ANGLES ± 0° 30' FINISH 63
EDGES & CORNERS .010 R MAX
MATERIAL

NEXT ASSY	USED ON
	1400H-003
APPLICATION	

DRN B SOUZA
APPD

HUGHES

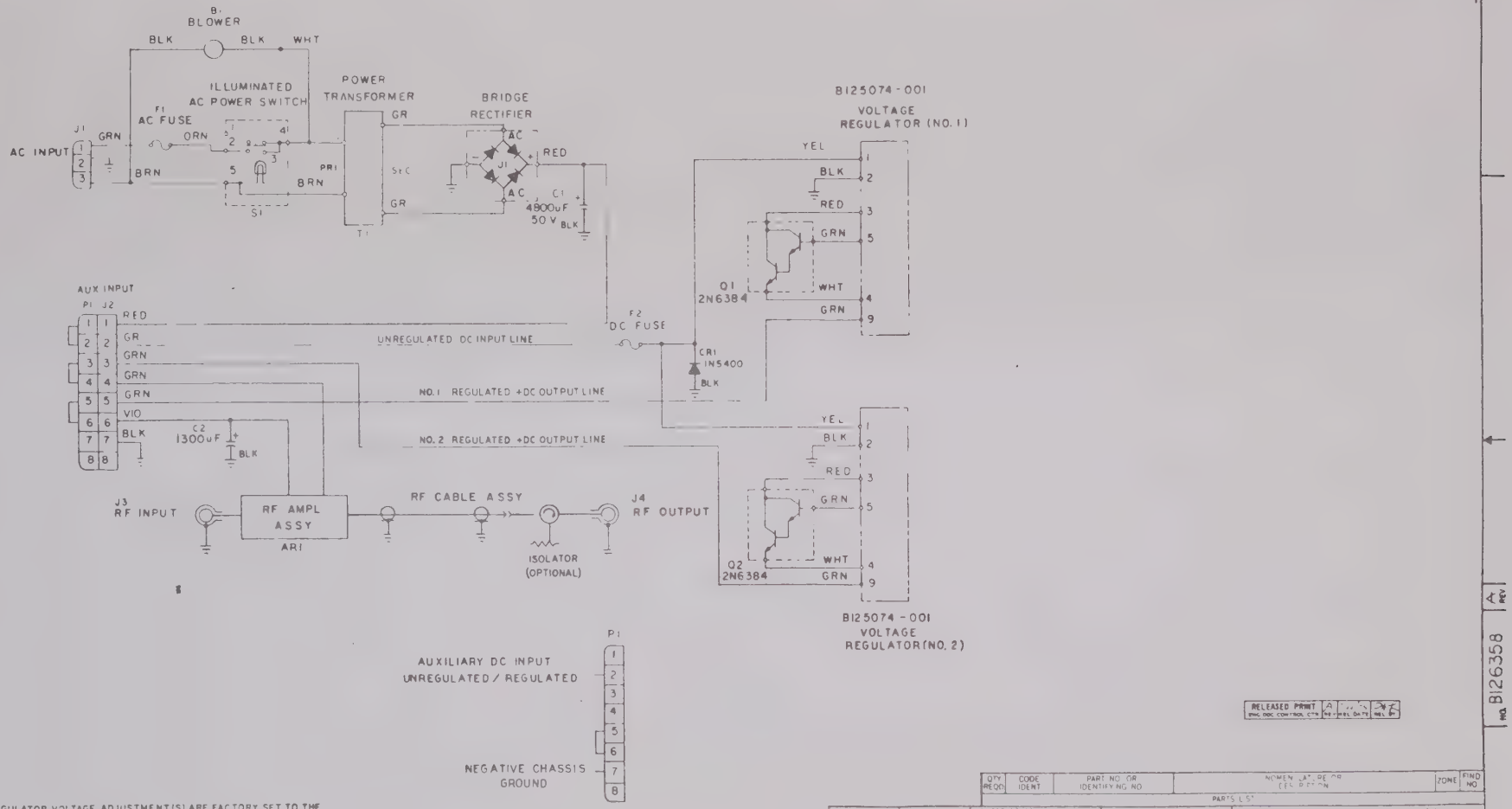
14XXH AMPLIFIER/ 1400H-003 POWER SUPPLY SCHEMATIC DIAGRAM

SIZE	CODE IDENT NO	DRAW NO
D	73293	B126357
SCALE —		SHEET 2 OF 2

FORM MAC 1088-B C5-ED 2-69 REV 11-70 PRINTED IN HOFFMAN CO. BLUEPRINT

APPENDIX X
SCHEMATIC DIAGRAM 1400H–004
POWER SUPPLY

REVISIONS						
EFF	AUTHORITY	ZONE	LTR	DESCRIPTION	DATE	APPROVED
			A	REVISED SH 2 AM	7 3 74	



2. REGULATOR VOLTAGE ADJUSTMENT(S) ARE FACTORY SET TO THE VOLTAGE VALUE(S) SPECIFIED ON THE LABEL OF THE RF AMPLIFIER ASSY. THESE VALUES MAY SUPERSEDE THOSE SPECIFIED IN THE TABLE.

1. FOR ELECTRICAL SPECIFICATIONS AND POWER TRANSFORMER CONNECTIONS NOT LISTED REFER TO TABLE B126358 OR THE CATALOG SHEET.

NOTES: UNLESS OTHERWISE SPECIFIED

RELEASED PRINT — ENG. DOC. CONTROL CTR. — A — REV. — REL. DATE — REL. BY

QTY REQD	CODE IDENT	PART NO. OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	ZONE	FIND NO.
			PARTS LIST		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
XXX ± .005 XX ± .02
ANGLES ±0° 30' FINISH 63
EDGES & CORNERS .010 R MAX
MATERIAL

DR B SOUZA 23 DEC 74
CHK
ENG
APPD

HUGHES — HUGHES AIRCRAFT COMPANY, ELECTRON DYNAMICS DIVISION, TORRANCE, CALIF. 90509

14XXH AMPLIFIER / 1400H-004 POWER SUPPLY
SCHEMATIC DIAGRAM

SIZE D | CODE IDENT 73293 | DRAWING NO. B126358
SCALE — | SHEET 1 OF 2

400H 1004
NEXT ASSY | USED ON
APPLICATION

A REV | NO. B126358

C

FORM MAC 1486-8 (3-ED 1.69 REV 12/70) DIETZGEN POST CLEARPRINT 1000+ M

APPENDIX XI
SPECIFICATIONS 1400H–004
POWER SUPPLY

REVISIONS					
EFF	AUTHORITY	ZONE	LTR	DESCRIPTION	DATE	APPROVED
			A	REVISED NOTE 5 AM	3-3-77	

ASSEMBLY CONTROL TABLE
14XXH SERIES AMPLIFIERS
USING 1400H-004 POWER SUPPLIES

MODEL NO EFFECTIVITY		SUB-ASSY USAGE		JSA SE		POWER REQUIREMENTS						FUSE RATINGS (AMPS)		MAINTENANCE SPECIFICATIONS										REFERENCE DETAILS				
						AC INPUT [6]			AUX DC INPUT [1]					VOLTAGE REGULATOR ASSY(S) [3]															
														DC TEST VALUES [4]				RESISTOR VALUES [5]										
														REG NO. 1		REG NO. 2		REG NO. 1		REG NO. 2								
INSTRUMENTATION AMPL SERIES 14XXH		SUB-ASSY IDENTIFICATION																						PART/ DWG NO	POWER TRANSFORMER			
MODEL NO.	SERIAL NO EFFECTIVITY	PWR SUPPLY 1400H DASH NO	RF AMPL MODEL NO	SLOT	FAN	V MIN	V MAX	LA MAX	V MIN	V MAX	A MAX	AC FUSE MAX	DC FUSE MAX	V MIN	A MIN	A MAX	V NOM	A MIN	A MAX	R5 NOM	R4 NOM	R5 NOM	R4 NOM		TERMINAL NO PRIMARY WDG	PRIMARY JUMPER	SECONDARY WDS	SECONDARY JUMPER
1408H	0018 & UP	004	46 SIH	YES	YES	98	132	245	NA	NA	NA	2.0SB	6.0	+15	—	5	+20	1.0	3.0	11K	0.27	20K	0.10	B109984	1,2	—	8,11	9,10
1408H-001		004	46 SIH	YES	YES	98	255	245	NA	NA	NA	1.0SB	6.0	+15	—	5	+20	1.0	3.0	11K	0.27	20K	0.10	B105883				
1410H	0018 & UP	004	46 SIH-C	YES	YES	108	132	245	NA	NA	NA	2.0SB	6.0	+15	0.5	5	+20	0.5	3.0	11K	0.27	20K	0.10	B109984	1,2	—	8,11	9,10
1410H-001		004	46 SIH-01C	YES	YES	98	132	245	NA	NA	NA	1.0SB	6.0	+15	0.5	1.5	+20	0.5	3.0	11K	0.27	20K	0.10	B105883				

[6] MAXIMUM AC INPUT POWER (VA) VALUES ARE FOR OPERATION OF THE AMPLIFIER UNDER THE FOLLOWING TWO SIMULTANEOUS CONDITIONS:
1) MAXIMUM RATED AC INPUT VOLTAGE.
2) CW OPERATION AT THE RATED POWER OUTPUT LEVEL OR GREATER

[5] RESISTOR VALUE R5 DETERMINES THE COARSE VOLTAGE SETTING OF THE REGULATOR; RESISTOR R4 DETERMINES THE MAXIMUM CURRENT LIMIT SETTING. VALUES ARE SHOWN IN OHMS. VALUES LESS THAN 1 OHM ARE ±1%; ALL OTHERS ARE ±5%

[4] MINIMUM VALUES OF CURRENT (A) ARE FOR QUIESCENT (ZERO SIGNAL/NO RF INPUT) AMPLIFIER OPERATION; MAXIMUM VALUES ARE FOR CW OPERATION AT THE RATED POWER OUTPUT LEVEL OR GREATER.

[3] THE AUXILIARY DC INPUT JACK J2 PROVIDES FOR SIMPLE MAINTENANCE TESTING (REF NOTE 2) OF THESE DC VOLTAGE(S) AND CURRENT (S).

[2] AUXILIARY DC OPERATION IS NOT FEASIBLE FOR THESE MODELS BECAUSE THE REQUIRED FORCED-AIR (FAN) COOLING SYSTEM IS NON-OPERATIVE IN THIS MODE.

1. NA = NOT APPLICABLE.

NOTES: UNLESS OTHERWISE SPECIFIED

QTY REQD	CODE IDENT	PART NO OR IDENTIFYING NO	NOMENCLATURE	ZONE	FIND NO

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
.XX ± .005 .XXX ± .002
ANGLES ± 0° 30' FINISH 63 EDGES & CORNERS .010 R MAX
MATERIAL

NEXT ASSY 1400H-004 USED ON
APPLICATION

HUGHES

14XXH AMPLIFIER
1400H-004 POWER SUPPLY
SCHEMATIC DIAGRAM

SIZE D | FSCM NO 73293 | DRAWING NO B126358
SCALE — | SHEET 2 OF 2

FORM HAC 11065-B C.S.ED. 2-69 REV. 12-78 DIETZGEN POST CLEARPRINT 1000H-10

C

APPENDIX XII
SPECIFICATIONS 1400H–XXX
SPECIAL POWER SUPPLY

REVISIONS					
EFF	AUTHORITY	ZONE	LTR	DESCRIPTION	DATE	APPROVED
			A	ADDED 1402HA-002	7-17-74	

ASSEMBLY CONTROL TABLE
14XXH-XXX SERIES AMPLIFIERS
CUSTOM (NON-CATALOG) PRODUCTS

MODEL NO EFFECTIVITY		SUB-ASSY USAGE		USAGE		POWER REQUIREMENTS						MAINTENANCE SPECIFICATIONS										REFERENCE DETAILS				
INSTRUMENTATION AMPL. SERIES 14XXH		SUB-ASSY IDENTIFICATION				AC INPUT [6]			AUX DC INPUT (OPTIONAL)			FUSE RATINGS (AMPS)		VOLTAGE REGULATOR ASSY(S) [3]								POWER TRANSFORMER				
														DC TEST VALUES [4]						RESISTOR VALUES [5]						
														REG NO. 1			REG NO. 2			REG NO. 1		REG NO. 2				
MODEL NO.	SERIAL NO EFFECTIVITY	PWR SUPPLY 14-XH DASH NO	RF AMPL MODEL NO	ISOLATOR	FAN	V		VA	V		A	AC FUSE	DC FUSE	V	A		V	A		R_3	R_4	R_5	R_4	PART/ DWG NO.	TERMINAL NO CONNECTIONS			
																									PRIMARY		SECONDARY	
						MIN	MAX	MAX	MIN	MAX	MAX	MAX	MAX	NOM	MIN	MAX	NOM	MIN	MAX	NOM	NOM	NOM	NOM		WDG	JUMPER	WDG	JUMPER
1409H	001-003	002	46149H	NO	YES	108	132	200	[2]	[2]	[2]	2.0 SB	4.0	+28	–	3.0	NA	NA	NA	27K	0	NA	NA	F-61X	–	–	GRN/YEL	–
1409H-001		002	46149H	NO	YES	198	255	200	[2]	[2]	[2]	1.0 SB	4.0	+28	–	3.0	NA	NA	NA	27K	0	NA	NA					
1409H-002	001	002	46150H	YES	YES	108	132	200	[2]	[2]	[2]	2.0 SB	4.0	+28	–	3.5	NA	NA	NA	27K	0	NA	NA	B109984	1,2	–	8,11	9-10
1401H-112	001	003	46111H-112	NO	NO	108	132	70	+22	+32	1.0	0.75 SB	1.5	+24	0.4	1.0	NA	NA	NA	24K	0.33	NA	NA	B109984	1,6	2-5	8,11	9-10
1402H-003	001	002	46104H	NO	YES	108	132	100	[2]	[2]	[2]	1.0 SB	2.5	+24	–	2.0	NA	NA	NA	24K	0.27	NA	NA	B109984	1,6	2-5	8,11	9-10
1402HA-002	001	001	46104HA	NO	NO	108	132	100	+22	+32	2.0	1.0 SB	2.0	+15	1.0	1.5	NA	NA	NA	15K	0.27	NA	NA	8696A	1,4	1-3,2-4	5,7	–

[6] MAXIMUM AC INPUT POWER (VA) VALUES ARE FOR OPERATION OF THE AMPLIFIER UNDER THE FOLLOWING TWO SIMULTANEOUS CONDITIONS:
1) MAXIMUM RATED AC INPUT VOLTAGE.
2) CW OPERATION AT THE RATED POWER OUTPUT LEVEL OR GREATER

[5] RESISTOR VALUE R_5 DETERMINES THE COARSE VOLTAGE SETTING OF THE REGULATOR; RESISTOR R_4 DETERMINES THE MAXIMUM CURRENT LIMIT SETTING. VALUES ARE SHOWN IN OHMS. VALUES LESS THAN 1 OHM ARE ±1%; ALL OTHERS ARE ±5%

[4] MINIMUM VALUES OF CURRENT (A) ARE FOR QUIESCENT (ZERO SIGNAL/ NO RF INPUT) AMPLIFIER OPERATION; MAXIMUM VALUES ARE FOR CW OPERATION AT THE RATED POWER OUTPUT LEVEL OR GREATER.

[3] THE AUXILIARY DC INPUT JACK J2 PROVIDES FOR SIMPLE MAINTENANCE TESTING (REF. NOTE 2) OF THESE DC VOLTAGE(S) AND CURRENT (S).

[2] AUXILIARY DC OPERATION IS NOT FEASIBLE FOR THESE MODELS BECAUSE THE REQUIRED FORCED-AIR (FAN) COOLING SYSTEM IS NON-OPERATIVE IN THIS MODE.

1. NA = NOT APPLICABLE.

NOTES: UNLESS OTHERWISE SPECIFIED

RELEASED PRINT ENG DOC CONTROL CTR | A | 7-17-74 RELEASED DATE | J.Z. RELEASED BY

QTY REQD	CODE IDENT	PART NO OR IDENTIFYING NO	NAMES & DESCRIPTION	ZONE	FIND NO
			PARTS LIST		

NEXT ASSY	USED ON
	1400H-004
	1400H-003
	1400H-002
	1400H-001

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
XXX ± .005 XX ± .02
ANGLES ± 0° 30' FINISH 63
EDGES & CORNERS .010 R MAX
MATERIAL

DR B. SOUZA 18 OCT 74
CHK 19 OCT 74
APPD 24 Oct 74

HUGHES AIRCRAFT COMPANY
ELECTRON DYNAMICS DIVISION
TORRANCE, CALIFORNIA

14XXH AMPLIFIER/ 1400H-XXX POWER SUPPLY SPECIFICATION TABLE

SIZE D | CODE IDENT NO 73293 | DRAWING NO B1260361

SCALE — | SHEET

B1260361 A

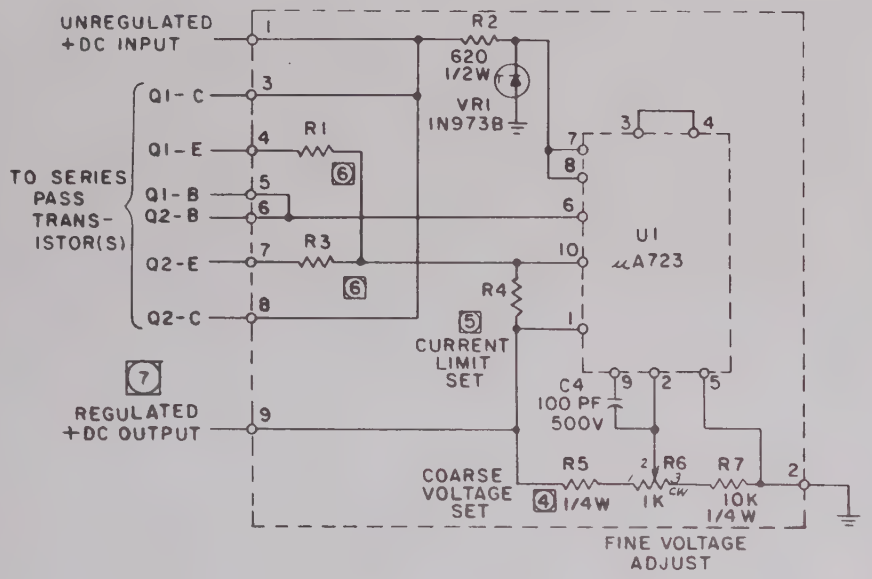
C

FORM MAC 11000-B-C5-ED 7-69 REV 12/70 BRITENCH-POST CLEARPRINT 1000H-10

APPENDIX XIII
SCHEMATIC DIAGRAM B125074
VOLTAGE REGULATOR

B125074 C

REVISIONS					
EFF	AUTHORITY	LTR	DESCRIPTION	DATE	APPROVED
		B	REDRAWN WITH CHANGES, DWG WAS C SIZE W.S.	8 NOV 74	
		C	GENERAL REV	7-22-75	



REDUCED SIZE

RELEASED PRINT ENG DOC CONTROL CTR	C REV	7-22-75 REL DATE	REL BY

(7) TABULATIONS OF OUTPUT VOLTAGES AND CURRENT LIMITS FOR SPECIFIED VALUES OF RESISTORS R1, R3, R4, AND R5, SEE ASSY DWG B125075 SHEET 2 OF 2 OR TABLES OF DWGS B126356, B126358, OR B126361.

(6) RESISTORS R1 AND R3 CONTROL CURRENT BALANCE BETWEEN SERIES PASS TRANSISTORS Q1 AND Q2.

(5) RESISTOR R4 SETS CURRENT LIMIT.

(4) RESISTOR R5 SETS COARSE VOLTAGE.

3. CAPACITANCE VALUES ARE IN MICROFARADS.

2. RESISTANCE VALUES ARE IN OHMS.

1. FOR ASSY DWG SEE B125075-001.

NOTES: UNLESS OTHERWISE SPECIFIED

PARTS LIST

QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	FIND NO
—		1400H-004		
—		1400H-003		
—		1400H-002		

NEXT ASSY | USED ON

APPLICATION

MATERIAL

EXCEPT AS NOTED DIM. ARE IN INCHES .XXX ± .005 .XX ± .02 FINISH 63/ ANGLES ± 0° 30' EDGES & CORNERS .010 R MAX.

DR B. SOUZA 6 NOV 74

CHK [illegible] 8 NOV 74

APPD [illegible] 11-8-74

HUGHES — HUGHES AIRCRAFT COMPANY ELECTRON DYNAMICS DIVISION TORRANCE CALIF 90509

DC VOLTAGE REGULATOR SCHEMATIC DIAGRAM

SIZE	CODE IDENT NO	DRAWING NO.
B	73293	B125074

SCALE — SHEET

FORM HAC-11063B CS-ED 2-68 DIETERICH-POST CLEARPRINT 1000H-10

APPENDIX XIV
WARRANTY PROVISIONS AND RETURN PROCEDURE SERVICE REPORT EDD REPRESENTATIVES

HUGHES
HUGHES AIRCRAFT COMPANY
ELECTRON DYNAMICS DIVISION

SOLID STATE PRODUCTS WARRANTY PROVISIONS

The Solid State Products sold by the Electron Dynamics Division of Hughes Aircraft Company and covered by this warranty, are warranted to be free from defects in material and workmanship at time of and for a period of one (1) year after delivery to the Buyer. Seller's entire warranty obligation is limited to making adjustments by repair, replacement, or refunding the purchase price of any product which is returned to Seller, as provided below within one (1) year from date of shipment by Seller.

Adjustment will not be allowed for products which have been subjected to abuse, improper application or installation, alteration, accident or negligence in use, storage, transportation or handling. Alteration or removal of serial number or identification markings void the warranty.

Seller shall have the right of final determination as to the existence and cause of a defect, whether adjustment will be allowed, and, if allowed, whether adjustment will be by repair, replacement or refund. Where adjustment is not allowed, a charge of 5% of the original purchase price will be made to Buyer to cover Seller's cost of inspection and handling.

Shipping and packaging instructions must be obtained from Seller before products are returned for adjustment. Buyer will pay for packing, transportation and transit insurance costs for returned products. Credit for transportation and transit insurance charges within the United States will be issued by Seller provided adjustment is allowed. Where adjustment is not allowed, products will be returned to Buyer transportation collect.

Subject to the provisions of its "Patent Indemnity" clause, Seller also warrants that it has the right to sell its products, that Buyer shall have and enjoy quite possession thereof as against any lawful claims existing at time of sale by Seller, and that said products are free from any charge or encumbrance in favor of third persons existing at the time of sale by Seller.

The foregoing constitutes Seller's entire warranty, express, implied, or statutory with respect to its products and states the full extent of its liability for breach of warranty and for damages, whether direct, special, or consequential, resulting from any such breach. No change whatsoever thereto shall be binding upon Seller unless in writing and signed by a duly authorized representative of Seller.

3100 West Lomita Boulevard, Torrance, California 90509, Tel (213)534-2121, TWX 910-347-6238

SERVICE REPORT

MODEL NUMBER _____ SERIAL NUMBER _____

DATE RECEIVED _____

DATE FIRST TESTED _____

DATE OF FAILURE _____

1. WAS OPERATION NORMAL PRIOR TO FAILURE? _____
2. IF NOT, DESCRIBE ABNORMAL CONDITIONS. _____

_____

_____

3. DESCRIBE INDICATIONS OF FAILURE. _____

_____

_____

_____

4. DESCRIBE PREVIOUS SERVICING OF INSTRUMENT, IF ANY. _____

_____

_____

_____

5. DESCRIBE APPLICATION.

_____

_____

_____

6. ADDITIONAL COMMENTS _____

_____

_____

_____

_____

OWNERS NAME _____ PREPARED BY _____

ADDRESS _____ TITLE _____

_____ DATE _____

HUGHES ELECTRON DYNAMICS DIVISION

SALES OFFICES AND REPRESENTATIVES

CALIFORNIA, NEVADA, ARIZONA, WASHINGTON

HUGHES EDD Sales Office
3100 West Lomita Boulevard
Torrance, California 90509
Tel (213) 534-2121
TWX (910) 347-6238

Blair Associates
421 North Brookhurst
Suite 220
Anaheim, California 92801
Tel (714) 635-1350

MCH Associates
4100 Moorpark Avenue
San Jose, California 95117
Tel (408) 246-7330
TWX (910) 338-0267

FRYCO
3705 North 75th Street
P.O. Box 460
Scottsdale, Arizona 85251
Tel (602) 945-3281

Datacom Associates
111 Tower Place
Seattle, Washington 98109
Tel (206) 285-2525

WYOMING, UTAH, COLORADO, NEW MEXICO, TEXAS

Fry–Gates
147 Madison, N.E.
Albuquerque, New Mexico 87108
Tel (505) 298-1875

Grifco Inc.
700 East Louisiana Avenue
Denver, Colorado 80210
Tel (303) 722-4674
TWX (910) 931-2570

CONNECTICUT, MAINE, MASSACHUSETTS, RHODE ISLAND, NEW HAMPSHIRE, VERMONT

Independent Marketing Reps.
7 Meehan Drive
South Chelmsford, Massachusetts 01824
Tel (617) 256-8251

27 Royal Crest Drive
Nashua, New Hampshire 03060
Tel (603) 888-3630

GEORGIA, ALABAMA, NORTH CAROLINA, SOUTH CAROLINA, FLORIDA

E. G. Homes & Associates, Inc.
4185 Clairmont Road
Chamblee, Georgia 30341
Tel (404) 451-6161

316½ South Bumby Street
Orlando, Florida 32802
Tel (305) 894-8901

DELAWARE, MARYLAND, WASHINGTON D.C., VIRGINIA

E. G. Holmes & Associates, Inc.
928 General Beauregard Drive
Virginia Beach, Virginia 23454
Tel (804) 481-6556

SONCO
11141 Georgia Avenue
Wheaton, Maryland 20902
Tel (301) 942-9420
TWX (710) 828-0527

NEW JERSEY, NEW YORK, PENNSYLVANIA

Graydon–Sherman, Inc.
111 Spring Street
Fayetterville, New York 13066
Tel (315) 637-9861
TWX (710) 541-0241

P.O. Box 206
Pittsford, New York 14534
Tel (716) 381-8838

M. Lader Company, Inc.
460 Germantown Pike
Lafayette Hill, Pennsylvania 19444
Tel (215) 825-3177

ASCO Electronics, Inc.
38 Oak Street
Tuckahoe, New York 10707
Tel (914) 779-8110
TWX (710) 562-0158

APPENDIX XV
CHANGE INFORMATION

"MANUAL CHANGE INFORMATION"

Due to the ever changing technology applied to these products, improvements are implemented as they are developed and tested. These changes may fail to be incorporated into the manual because of scheduling requirements. Therefore, the following pages contain change information affecting this manual. If no changes are entered on the following pages your manual is correct as printed.

HUGHES POWER AMPLIFIERS

HUGHES

HUGHES AIRCRAFT COMPANY

ELECTRON DYNAMICS DIVISION

Traveling-wave tube amplifiers

Specifications*

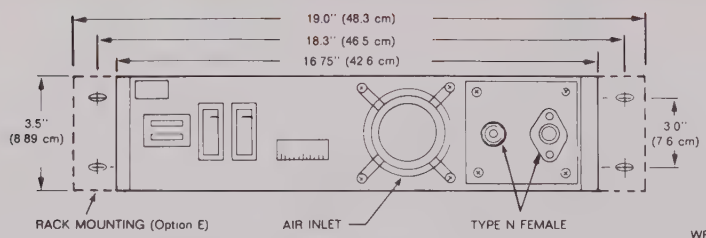
Frequency range (GHz)	Minimum power output (W max.)	Gain at rated power output (dB min.)	Duty	Input voltage Standard (Vac, Hz)	Input voltage Option G (Vac, Hz)	Input voltage Option A (Vac, Hz)	Input voltage Option I (Vdc)
1.0-2.0	10	30	CW	115, 50-60	115±10%, 48-420	220 or 240, 50-60	28
1.0-2.0	20	30	CW	115, 50-60	115±10%, 48-420	220 or 240, 50-60	28
1.4-2.4	20	30	CW	115, 50-60	115±10%, 48-420	220 or 240, 50-60	28
2.0-4.0	10	30	CW	115, 50-60	115±10%, 48-420	220 or 240, 50-60	28
2.0-4.0	20	30	CW	115, 50-60	115±10%, 48-420	220 or 240, 50-60	28
2.5-4.0	20	30	CW	115, 50-60	115±10%, 48-420	220 or 240, 50-60	28
3.0-8.0	10	30	CW	115, 50-60	115±10%, 48-420	220 or 240, 50-60	28
3.9-11.7	10 **	30**	CW	115, 50-60	115±10%, 48-420	220 or 240, 50-60	28
4.0-8.0	10	30	CW	115, 50-60	115±10%, 48-420	220 or 240, 50-60	28
4.0-8.0	20	30	CW	115, 50-60	115±10%, 48-420	220 or 240, 50-60	28
4.0-10.5	10	30**	CW	115, 50-60	115±10%, 48-420	220 or 240, 50-60	28
5.0-10.0	10	30	CW	115, 50-60	115±10%, 48-420	220 or 240, 50-60	28
6.5-13.5	10	30	CW	115, 50-60	115±10%, 48-420	220 or 240, 50-60	28
7.0-16.5	10	30	CW	115, 50-60	115±10%, 48-420	220 or 240, 50-60	28
8.0-12.4	10	30	CW	115, 50-60	115±10%, 48-420	220 or 240, 50-60	28
8.0-12.4	20	30	CW	115, 50-60	115±10%, 48-420	220 or 240, 50-60	28
8.0-18.0	10	30	CW	115, 50-60	115±10%, 48-420	220 or 240, 50-60	28
10.5-18.0	10	30	CW	115, 50-60	115±10%, 48-420	220 or 240, 50-60	28
12.4-18.0	10	30	CW	115, 50-60	115±10%, 48-420	220 or 240, 50-60	28
12.4-18.0	20	30	CW	115, 50-60	115±10%, 48-420	220 or 240, 50-60	28
18.0-26.0	1	30	CW	115, 50-60	115±10%, 48-420	220 or 240, 50-60	28

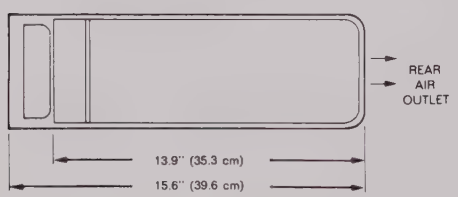
Protection and special features
Automatic time delay/Helix current overload/Thermal overload.
RF output connector interlock for all coaxial connector units.
dc heater supply (Option B)

Warranty
One full year regardless of the hours of operation.

*Specifications are subject to change, however, those in effect upon acceptance of order will prevail

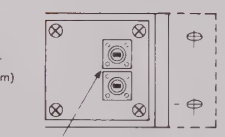
**Slightly lower at band edges.



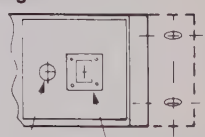


NOTE: 1.0-2.0 GHz UNITS HAVE A MODIFIED REAR PANEL FOR TWT PROTECTION. DETAILS AVAILABLE UPON REQUEST.

Model 1077H11 connector configuration



Models 1177H04, 1177H15, 1177H08 and 1277H04 connector configurations



NOTE: SMA OR WAVEGUIDE UNITS WILL NOT HAVE RF INTERLOCKS

Hughes TWTAs are the lightest and most compact portable TWTAs you can buy. They're ready to go anywhere the job takes them; with regulated solid-state power supply and a complete air cooling system. Models are available in either standard or multi-band frequency ranges from 1 to 18 GHz. All are warranted for one full year regardless of the hours of operation.

Input voltage Option M (Vdc)	**Power consumption** (W max.)	**Noise figure** (dB)	**Spurious modulation** (at saturation) (dB)	**VSWR** (max.)	**Operating temperature** (° C ambient)	**Weight** (lbs., (kg.) max.)	**Replacement tube model number**	**Amplifier model number**
-48 ±3	250	35	-50	3:1	0-50	25 (11.34)	417HD	**1177H09**
-48 ±3	250	35	-50	3:1	0-50	25 (11.34)	418H	**1277H09**
-48 ±3	250	35	-50	3:1	0-50	20 (9.1)	419H	**1177H10**
-48 ±3	250	35	-50	3:1	0-50	20 (9.1)	564H	**1177H01**
-48 ±3	250	35	-50	3:1	0-50	20 (9.1)	568H	**1277H01**
-48 ±3	250	35	-50	3:1	0-50	20 (9.1)	564HS	**1177H05**
-48 ±3	250	35	-50	3:1	0-50	20 (9.1)	646H	**1177H13**
-48 ±3	250	35	-50	3:1	0-50	20 (9.1)	664H	**1177H16**
-48 ±3	250	35	-50	3:1	0-50	20 (9.1)	648HD	**1177H02**
-48 ±3	250	35	-50	3:1	0-50	20 (9.1)	640H	**1277H02**
-48 ±3	250	35	-50	3:1	0-50	20 (9.1)	648HDS	**1177H06**
-48 ±3	250	35	-50	3:1	0-50	20 (9.1)	746H	**1177H14**
-48 ±3	250	35	-50	3:1	0-50	20 (9.1)	771HDS	**1177H07**
-48 ±3	250	35	-50	3:1	0-50	20 (9.1)	785HD	**1177H17**
-48 ±3	250	35	-50	3:1	0-50	20 (9.1)	771HD	**1177H03**
-48 ±3	250	35	-50	3:1	0-50	20 (9.1)	783H	**1277H03**
-48 ±3	250	35	-50	3:1	0-50	20 (9.1)	848HDS	**1177H08**
-48 ±3	250	35	-50	3:1	0-50	20 (9.1)	846H	**1177H15**
-48 ±3	250	35	-50	3:1	0-50	20 (9.1)	848HD	**1177H04**
-48 ±3	250	35	-50	3:1	0-50	20 (9.1)	856H	**1277H04**
-48 ±3	250	35	-50	3:1	0-50	20 (9.1)	911H	**1077H11**

To order specify **1177H 01 F-000**

1077H
1177H
1277H

01—2.0 to 4.0 GHz
02—4.0 to 8.0 GHz
03—8.0 to 12.4 GHz
04—12.4 to 18.0 GHz
05—2.5 to 4.0 GHz
06—4.0 to 10.5 GHz
07—6.5 to 13.5 GHz
08—10.5 to 18.0 GHz
09—1.0 to 2.0 GHz
10—1.4 to 2.4 GHz
11—18.0 to 26.0 GHz
13—3.0 to 8.0 GHz
14—5.0 to10.0 GHz
15—8.0 to 18.0 GHz
16—3.9 to 11.7 GHz
17—7.0 to 16.5 GHz

F—Front Panel Connector
R—Rear Panel Connector †

†Not available on Model 1277H04

000-Standard Unit
XXX-Factory Assigned Special

Options

A. 220/240 V Input Voltage An auto-transformer allows operation at 220 Vac ±10% or 240 Vac ±10% at 50/60 Hz.

B. dc Heater Supply Reduces spurious content. It is incorporated in all amplifiers at no cost.

C. Helix Voltage Regulator Incorporates a regulator in the helix circuit to improve short and long term gain stability and reduce gain variations due to temperature effects. Important for communications applications or any application requiring a high degree of gain stability.

D. Unattended Protection For use in unattended applications such as ranges, components aging, ground terminals, communication links, etc. Protects amplifier from damage due to extended operation in standby mode by turning off power in event of helix overload. To restore the unit to RF on, the ac power line must be interrupted or the power switch must be cycled. The unit will then time-in with the normal (heater warm-up) time delay.

E. Rack Mounting Allows the unit to be mounted in a 19-inch rack Available at no cost.

F. Local/Remote Duplicates the amplifier's switches and status lights up to 50 feet. This enables the user to locate the unit in remote areas such as radar towers, environmental chambers, RF screen room, etc.

G. 48 to 420 Hz Offers the capability of operating at any input frequency from 48 to 420 Hz.

H. Logic Circuit (TTL) Consists of computer compatible (TTL) logic command and control circuitry. Turn-on, turn-off, and reset functions, as well as full status indication are remotely provided. Line power must be supplied through an isolation transformer external to the amplifier. A 28 volt source is needed to operate control circuits.

I. 28 V Input Voltage Allows the unit to operate from a 28 (±3) volt dc bus for various airborne and communications applications or special lab requirements.

J. Isolators/Circulators Provides an isolator internal to the traveling-wave tube amplifier package to protect the tube from varying VSWR conditions. Rated power output on the traveling-wave tube amplifier is dependent upon insertion loss of isolators. Price and availability dependent on customer's band of interest and power requirements.

K. High Gain A solid-state pre-amp in conjunction with the TWT to provide high gain when minimal drive power is available. Availability, price and delivery is dependent on customer's band of interest and gain requirements.

L. Automatic Reset In the event of a momentary fault condition, such as a line voltage surge, helix overload, or temporary RF power reflections, the unit reverts to "READY." This option automatically recycles the TWTA from "READY" to "RF ON" after an approximate 4-second delay. Recycling can be set for 1 to 8 times or set to recycle continuously. If the fault condition continues after the pre-determined number of reset cycles, the unit will revert to the "OFF" mode. The fault condition must then be cleared and the amplifier manually reset. This option is valuable in remote unattended sites, such as antenna ranges, satellite earth stations, and communication links.

M. -48 V Input Voltage Allows the amplifier to be operated, from a -44 V to -56 Vdc bus. It is designed for telecommunication applications.

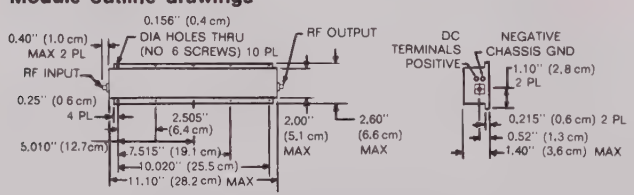
Wideband transistor linear power amplifiers

2 - 8400 MHz — 0.5 - 100 watt series instruments and modules

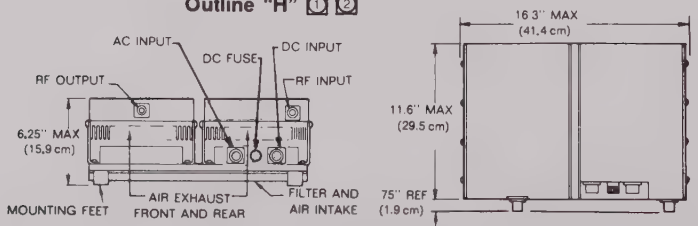
Specifications*		0.5 Watt series						1 Watt series				
Class of operation		A	A	A	A	A	A	A	A	A	A	A
Frequency/Bandwidth	MHz min.	2	1000	2000	3700	5900	7900	2	500	750	1000	1700
	MHz max.	1000	2000	4000	4200	6400	8400	1000	1000	1500	2000	2400
Large signal power response												
Rated power output	W min.	0.5	0.5	0.5	0.5	0.5	0.5	1	1	1	1	1
Saturated power output	W typ.	1.0	1.0	0.8	0.8	0.6	0.6	2	2	2	2	1.5
Power input, for rated output	mW typ.	1	1	1	1	1	1	1	1	1	1.6	1.6
Power input, without damage	mW max.	10	10	10	10	10	10	20	50	20	20	20
Gain												
Large signal gain, at rated output	dB min.	27	27	27	27	27	27	30	30	30	28	28
Small signal gain	dB typ.	30	30	30	30	30	30	35	33	35	33	33
Ripple												
Gain variation	dB typ.	±1.5	±1	±1	±0.5	±0.5	±0.5	±1.5	±1	±1	±1	±1
Phase variation, deviation from linear	deg/100 MHz typ.	±10	±5	±5	±5	±5	±5	±10	±5	±5	±5	±5
Linearity												
Compression point, gain, -1dB	dBm typ.	27	27	27	27	25	25	30	30	30	30	29
Intercept point, 3rd order	dBm typ.	37	37	36	36	35	35	40	40	40	40	39
Dynamic range	dB typ.	60	60	60	60	60	60	60	60	60	60	60
Distortion												
Intermodulation distortion, 3rd order products	dBc[1] typ.	-25	-20	-15	-20	-15	-15	-25	-30	-25	-15	-15
Second harmonic output	dBc[1] typ.	-20	-20	-20	-30	-30	-30	-20	-20	-20	-20	-25
Noise												
Spurious output	dBc[1] min.	-60	-60	-60	-60	-60	-60	-60	-60	-60	-60	-60
Noise figure	dB typ.	10	10	10	7	7	7	10	12	10	10	10
VSWR												
Input VSWR	max.	2:1	2:1	2:1	2:1	2:1	2:1	2:1	3:1	2:1	3:1	3:1
Load VSWR, operating as specified	typ.	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1
Load VSWR, without damage, at rated output	max.	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
Load VSWR, without damage, above rated output	max.	3:1	3:1	3:1	3:1	3:1	3:1	3:1	3:1	3:1	3:1	3:1
Impedance												
Input impedance	Ω typ.	50	50	50	50	50	50	50	50	50	50	50
Output impedance	Ω typ.	50	50	50	50	50	50	50	50	50	50	50
Primary power input												
Instrument												
Voltage, domestic	Vac ±12	120	120	120	120	120	120	120	120	120	120	120
Voltage, export	Vac ± 28	226	226	226	226	226	226	226	226	226	226	226
Power, at 50-60 Hz	VA max.	60	60	70	70	70	110	70	70	70	70	110
Module												
Voltage	Vdc	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24
Current	A max.	0.75	0.75	1	1	1.2	1.5	1.2	1	1.2	1	1.5
Cooling system/Operating temperature[2]												
Instrument		AIR	AIR	AIR	AIR	AIR	AIR	AIR	AIR	AIR	AIR	AIR
Module power dissipation	W max.	18	18	24	24	24	24	29	24	29	24	36
Outline drawing												
Instrument		Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
Module		H	H	H	H	H	H	H	H	H	H	H
Model number												
Instruments, 14XX H (XX = 2 digits from table)		80	81	82	83	84	85	08	01	07	03	05
1510 H - XXX (XXX = 3 digits from table)		-	-	-	-	-	-	-	-	-	-	-
1520 H - XXX (XXX = 3 digits from table)		-	-	-	-	-	-	-	-	-	-	-
Modules, 46XX X H (XXX = 3 digits from table)		180	280	480	580	581	582	132	111	221	211	311

1. dB referenced to the carrier at the rated power output.
2. All amplifiers rated at 5 watts or greater have internal Thermal Overload Protection with automatic self-recovery. Instrument: Operating Temperature 0 to + 50 C, ambient for models having AC power ratings less than 140VA: + 15 to + 35 C for models having higher AC power ratings. Module: Operating Temperature 0 to + 71 C, chassis base. It is the user's responsibility to provide cooling adequate to limit the amplifier temperature to + 71 C.

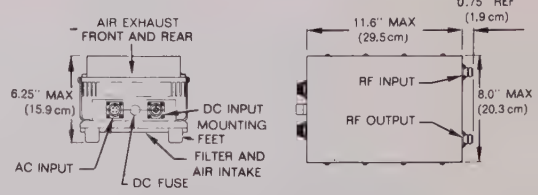
Module outline drawings



Outline "H" ① ②



Outline "V" ② ⑤ ⑥ ⑦ ⑧



Outline "U" ② ⑤ ⑥ ⑦ ⑧

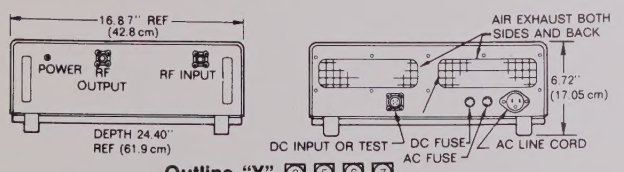
Hughes wideband transistor solid-state linear amplifiers are designed for high gain, high power amplification providing low distortion and a large dynamic range. Operational features include protection from high load VSWR, input signal overdrive, over-voltage and reverse input polarity.

Available with integral power supply and cooling system, or as modules for system applications. Instruments operate from 115 Vac or 230 Vac input, modules from low voltage dc.

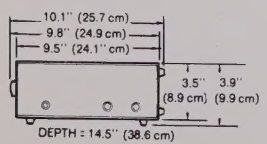
2 Watt series						5 Watt series**				10 Watt series **				20 Watt series**			50 Watt series			100 Watt series		
A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
2	50	500	750	1000	1700	50	500	750	1000	50	500	750	1000	50	500	750	125	500	750	125	200	250
500	500	1000	1500	2000	2400	500	1000	1500	2000	500	1000	1400	2000	500	1000	1400	500	750	1000	250	400	500
2	2	2	2	2	2	5	5	5	5	10	10	10	10	20	20	20	50	50	50	100	100	100
3	3	3	3	3	3	8	8	7	7	15	15	15	10	25	25	25	80	63	63	125	125	125
2	0.6	3	2	2	1	5	5	1.6	1.6	1	3	1	1	5	2	2	1	3	3	1	1	1
20	10	50	20	20	10	20	20	20	20	10	20	20	20	20	50	20	10	50	50	10	10	10
30	35	28	30	30	33	30	30	35	35	40	35	40	40	35	40	40	47	42	42	50	50	50
35	39	33	35	35	38	35	35	40	40	45	40	45	45	40	45	45	52	47	47	55	55	55
±1.5	±1	±1	±1	±1	±1	±1.5	±1	±1	±1	±1.5	±1	±1	±1	±1.5	±1	±1	±1.5	±1	±1	±1	±1	±1
±10	±5	±5	±5	±5	±5	±5	±5	±5	±5	±5	±5	±5	±5	±5	±5	±5	±10	±5	±5	±5	±5	±5
33	33	33	33	32	32	37	37	36	36	40	39	38	38	42	42	41	46	45	45	47	47	47
43	43	43	43	43	42	47	47	46	46	49	49	49	48	52	52	51	56	55	55	57	57	57
60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
-20	-20	-25	-20	-15	-15	-20	-20	-18	-15	-18	-18	-17	-16	-17	-15	-16	-15	-17	-17	-15	-15	-15
-20	-20	-20	-20	-20	-25	-20	-20	-20	-20	-20	-20	-30	-15	-20	-20	-30	-20	-20	-20	-15	-15	-15
-60	-60	-60	-60	-60	-60	-60	-60	-60	-60	-60	-60	-60	-60	-60	-60	-60	-60	-60	-60	-60	-60	-60
10	10	12	10	10	10	10	12	10	10	10	12	10	10	10	12	10	10	12	12	10	10	10
2:1	2:1	3:1	2:1	2:1	3:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1
2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1
∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
3:1	3:1	3:1	3:1	3:1	3:1	3:1	3:1	3:1	3:1	3:1	3:1	3:1	3:1	3:1	3:1	3:1	3:1	3:1	3:1	3:1	3:1	3:1
50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120
226	226	226	226	226	226	226	226	226	226	226	226	226	226	226	226	226	226	226	226	226	226	226
70	70	70	110	110	150	150	250	290	330	330	330	500	385	500	900	1000	1200	1200	1200	1500	1500	1500
+24	+24	+24	+24	24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+24	+28	+28	+28
1.2	1.2	1.2	2	2	3	3	4	5	6	6	6	8	7	8	15	17	20	20	20	24	24	24
AIR	AIR	AIR	AIR	AIR	FAN	FAN	FAN	FAN	FAN	FAN	FAN	FAN	FAN	FAN	FAN	FAN	FAN	FAN	FAN	FAN	FAN	FAN
25	25	25	50	50	75	75	100	120	150	150	150	200	168	200	360	400	500	500	500	672	672	672
Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Y	Z	Y	Y	Y	Y	Y	Y	Y	Y	Y
H	H	H	H	H	U	H	H	U	U	U	U	U	U	U	V	V	V	V	V	V	V	V
19	15	04	12	13	25	16	06	51	52	17	11	-	40	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	252	-	158	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	170	253	155	156	157	096	097	198
131	130	110	208	209	321	136	146	232	239	141	148	252	277	158	170	253	155	156	157	096	097	198

*Specifications are subject to change; however, those in effect upon acceptance of order will prevail. **Some models available with reduced bandwidths at lower costs.

Instrument outline drawings



Outline "Y" [3] [5] [6] [7]



Outline "Z" [3] [4] [5]

[1] RF connectors are type SMA jacks; Type "N" jacks are optional.

[2] An integral fan-cooled heat sink is standard in outlines "U" and "V"; Heat sink is optional for "H".

[3] 19" (48.26) rack mounting available at no cost.

[4] This unit may be operated in two different planes. Optionally, a 19" (48.3 cm) rack mounting adapter kit is available. Weight 13-17 lbs. (5.9-7.7 kg).

[5] RF connectors are type "N" jacks.

[6] Feet are removable, however, air intake for blowers must be provided.

[7] DC input MS 3102A 14S-6P; mating connector MS 3106B14S-6S supplied.

[8] Internal blower AC input MS 3102A14S-2P; mating connector MS 3106B14S-2S supplied.

Your local representative

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